

FOURTH EDITION

CREATIVE PROBLEM SOLVING FOR MANAGERS

Developing skills for decision making and innovation

TONY PROCTOR

Creative Problem Solving for Managers

Fourth edition

How can managers tackle complex problems? How do you encourage innovation? How do you implement new solutions? Is creativity the key to management success? In answering these questions, this accessible text provides a lively introduction to the essential skills of creative problem solving.

Using extensive case studies and examples from a variety of business situations, *Creative Problem Solving for Managers* explores a wide range of problem-solving theories and techniques, illustrating how these can be used to solve a multitude of management problems. Thoroughly revised, this new edition retains the accessible and imaginative approach to problem-solving skills of previous editions.

Coverage includes:

- advice on overcoming blocks to creativity
- key techniques, including lateral thinking, morphological analysis, synectics and group problem solving
- new PowerPoint slides to aid course leaders
- a revised and updated chapter on using computers to stimulate creative thought.

As creativity is increasingly being recognized as a key skill for successful managers, this book will be welcomed as a readable and comprehensive introduction for students and practising managers alike.

Tony Proctor is Emeritus Professor of Marketing at the University of Chester, UK.

Given the uncertainties of the organisational environment, the ability to creatively approach, manage and resolve problems that are difficult to describe and structure will be an increasingly valued business skill. This new edition of *Creative Problem Solving for Managers* offers up-to-date guidance on how to approach and resolve such problems.

Jon Curwin, *Senior Learning and Teaching Fellow,
Birmingham City Business School, UK*

You will never again approach creativity and problem solving in quite the same light. Taking into account both the 'what' and the 'how', this valuable book provides readers with the knowledge needed to solve a range of management problems. A masterpiece!

Dr Kim Hua Tan, *Reader, The University of Nottingham, UK*

Creativity is a fundamental skill for business managers. Tony Proctor's book provides an excellent practical guide to this topic. The case studies, creativity techniques and the pragmatic knowledge and insights within this book make it essential reading for managers, facilitators and students alike.

Dr Elspeth McFadzean, *Visiting Academic Fellow,
Henley Business School, the University of Reading, UK*

Essential reading for anyone aspiring to enhance organisational creativity and innovation. Supported by comprehensive and in-depth discussion of theory, this book provides an approach to creativity that really does work in practice. I have used previous editions as a core text at undergraduate and postgraduate levels and am inspired by the updates in this fourth edition. Lots of useful cases and examples to stimulate debate, including the use of technologies in creativity, brings this edition right up to date.

Dr Pauline Loewenberger, *Lecturer,
the University of Bedfordshire Business School, UK*

This is an excellent book for understanding how best to approach complex situations and come out with creative solutions to the strategic problems that managers face. Grounded in practice and providing detailed case studies of real business situations, this book gives readers a solid foundation for developing their own creative solutions to problems.

Paul Hughes, *Senior Lecturer, Durham University, UK*



Creative Problem Solving for Managers

**Developing skills for decision
making and innovation**

Fourth Edition

Tony Proctor

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Preface to the fourth edition

Interest in creative problem solving never seems to wane. Perhaps this is not too surprising since the world is constantly changing and presenting new challenges. Pathways to the solutions of new kinds of problems are always in demand. In a world where nothing is certain and even long-established businesses can begin to crumble in a matter of months, radical new ways of looking at problems seem to be the order of the day. Creative thinking is not the ‘universal antidote’ capable of curing all, but it offers ways of examining problems that force us to question fundamental issues. It makes us challenge basic assumptions. There are no such things as firm foundations – the bedrocks of civilization can crumble into dust while we look on in awe and trepidation!

I am often asked whether the various approaches I outline in this book really work. The answer to this, I feel, is really only known by those who use the methods. Moreover, it is always difficult to know if you would have been able to find an answer to a problem you did not know existed without the aid of the techniques I outline here. Or, indeed, for that matter, whether you might solve the problem more to your satisfaction by using other methods.

The material contained in this book should appeal to a wide audience. I originally thought the subject matter was something that would, perhaps, most interest experienced and mature adults. I discovered that not only was it something that appealed to experienced managers, but it also held the attention of management students of all ages and backgrounds. One of my most enlightening experiences has been getting final-year undergraduates interested in the subject.

The subject matter of this book will appeal to people who have a variety of different interests in management. Whether your primary interest is in accounting, personnel management, marketing, production, research and development, and so on, does not really matter since the subject matter contained in this book is relevant to all these interests. However, you must approach the subject with an open mind; and all the methods, no matter how ridiculous they may seem, should be treated seriously – but not so seriously that they cannot be enjoyed. The greatest barrier to appreciating the subject matter of this book is scepticism.

I have made quite a lot of changes to the book from its third edition and expanded it from twelve to fifteen chapters. Here is a brief synopsis of the content of the book.

Chapter 1 looks at the nature of changing times and reviews some definitions of creativity. It also explains the nature of invention and innovation, distinguishing in the latter case between product and process innovation. It highlights the importance of creative problem solving in enabling business executives to cope with novel or new problems. In examining the importance

of creativity to business and managers, the chapter picks out those instances where it is most needed. The chapter ends by explaining the concept of paradigm shift and its relevance to business, managers and creative thinking.

Chapter 2 argues that the blocks to creative thinking are essentially of two varieties – individual and organizational. First, it turns our attention to the various personal blocks that people may encounter when trying to solve problems, think creatively and deal with new kinds of problems. These blocks are to do with mindset and with factors to do with perception, emotion, expression and cultural influences. The chapter then continues by discussing how these blocks can be diagnosed in individuals and overcome. It then moves on to blocks encountered in organizational settings and the conditions which are needed to circumvent them and encourage creativity in organizations.

Chapter 3 argues that creativity is explained best by the neuro-physiological functioning of the brain. It envisages a connection between the neuro-physiological functioning of the brain and the cognitive theory of creative problem solving discussed later in the chapter. It then gives attention to other important contributions to the theory of creative thinking. We look specifically at the notion of divergent and convergent thinking, and adopt the suggestion that the conditions under which ideation takes place are very important. We finish the chapter by looking at analogical reasoning, which is a cornerstone of many of the creative problem solving techniques we encounter later in the book and a building block of everyday thinking.

Chapter 4 concentrates first on problem solving and later on the concept of creative problem solving. General ideas about problem solving and types of problem are discussed and several models of the process examined. This precludes a discussion later in the chapter which considers the process of creative problem solving. It looks at insights into problems and how they arise. Again, different models of the creative problem solving process are examined. The chapter concludes by discussing limitations that can apply when adopting formal problem-solving approaches.

Chapter 5 offers an explanation concerning the suitability of the techniques outlined in subsequent chapters for gaining insights into different kinds of problem. It also puts forward the idea that different techniques may be perceived differently by different individuals. Not everyone is likely to feel comfortable using some of the techniques and there are good reasons for this. In this chapter we examine some of the main thoughts that address these issues. We look first at how an individual's characteristics and modes of thinking and learning may impact on the use of the techniques in the creative problem-solving process (this is also extended to the group situation). We then look at which techniques are most suitable for solving different types of problems.

Chapter 6 examines the process leading up to establishing and defining the problem. This is seen as a multistage process. The first stage, objective finding, essentially involves 'divergent thinking to generate a list of problems or problem symptoms'. This is followed by convergence of thought to identify the most relevant problem areas for further exploration. Next is the fact-finding stage, where overall comprehension of the problem is increased by the collection of relevant information. This also helps new ideas to be generated. The previously identified problem(s) may now be seen from a new perspective. There are a variety of problem definition mechanisms which we explore in the course of the chapter.

Chapter 7 introduces morphological analysis and related techniques. The techniques we look at are essentially systematic structuring mechanisms designed to facilitate the gaining of

insights into the problem. A variety of techniques are considered including checklists, listing, morphological analysis, force-fit triggers, the heuristic ideation process and component listing. If the subject of a problem has one or more easily identifiable dimension most of these techniques may be useful tools for helping to generate ideas.

Chapter 8 reviews some of the more popular forms of brainstorming. These include classical brainstorming, wildest-idea variant, round-robin brainstorming, Gordon–Little variant, trigger method, brainwriting and brainlining (brainstorming on the Internet). Limitations of brainstorming as a method are also examined.

Chapter 9 discusses ‘lateral thinking’ under the headings of awareness, alternatives and provocative methods. The chapter considers each of these aspects in turn. Lateral thinking does advocate some ideation methods, and these come under the heading of provocative techniques. They include random stimulus, intermediate impossible, reversals, distortion and exaggeration, exposure, cross-fertilization and problem switching. These, along with the use of metaphors and analogies, are also covered as well as thoughts about the discontinuity principle.

Chapter 10 takes a look at the subject of synectics. A method of using synectics is outlined and discussion given over to considering the various components that make up the synectics process. The chapter explains the four different types of analogies used and gives illustrations of each.

Chapter 11 addresses the subject of breakthrough ideation. It starts by examining how a breakthrough idea was achieved many years ago and tries to draw some lessons from this. This is followed by examining a number of techniques that have been tried out in recent times to achieve break-through ideas. Visualization, symbolic representation and rich pictures are all mechanisms that can support this kind of thinking. Two other mechanisms are also discussed: wishful thinking and role playing. Finally, we point to the benefits that disruptive technologies can bring for those who discover and commercialize them. Such breakthroughs reflect paradigm shifts.

Chapter 12 reviews some of the many remaining methods of creative problem-solving techniques that may be used. Many such techniques are illustrated and discussed on various websites on the Internet and in books written for the popular press. Most of these techniques are straightforward and would fit into MacFadzean’s category of paradigm preserving techniques. Some require more imaginative thinking and could lead to paradigm stretching or even paradigm breaking.

Chapter 13 looks at methods of evaluation ranging from simple checklists to complex weighted scoring systems. First, however, it looks at sorting methods before examining evaluation methods. Many of the ideation methods that will have been examined in the previous chapters produce a large quantity of ideas. Before we can evaluate these ideas we need to sort them into categories or themes. This facilitates the process of making comparisons and evaluations. Finally, we give some thought to exercising choice.

Chapter 14 reviews some of the problems of implementing ideas. First consideration is given to the various sources of resistance to change. Next we look at the role of communication in overcoming resistance to change. This is followed by an examination of how ideas might be put into action. Lastly, the chapter looks at how one might foster a climate for change in an organization. It also reviews a number of techniques and methods that can assist in the implementation of ideas.

Chapter 15 mentions the range of computer software that can be used to assist creative problem solving stretching from purpose-built software to more general-purpose software. The amount of software available has expanded considerably over the past few years with recent development of applications that will run on hand-held and mini computers fitted with touch screens – commonly referred to as ‘apps’. Developments on the Internet have also led to the setting up of social network sites and these too have facilitated the ideation process. Conventional computer software may be used creatively. Photographs and videos can act as a spur to ideation and, with the aid of computers, their use can be made in creative problem-solving sessions.

Throughout the book there are ample illustrations of the key points. There are specific case studies attached to each chapter. The latter invite the reader to make use of all the knowledge he or she has gained about the creative problem-solving process through reading the book. In this the fourth edition I have also added new material as appropriate. In view of the additional material included in the chapters, the Reference section has been substantially added to and many recent references included. At the same time as adding new material, I have deleted some of the old material where I thought it was less appropriate.

My thanks to Dr Elspeth McFadzean for her thoughts that techniques might be considered in the light of whether they are useful in *paradigm preserving*, *paradigm stretching* or *paradigm shifting*. I am also grateful to anonymous reviewers for comments that led me to include the new material.

Tony Proctor, 2013

Creativity and its importance in business

Aircraft pollution

With the advent of the jet engine and advanced navigational instrumentation the airline industry was born. The death knell was sounded for the transatlantic passenger liners, and as one product life-cycle drew to a close a new one began. The jet engine heralded a paradigm shift in civil aviation, and creativity was needed to harness, to exploit and to market the applications of the newfound technology. Some fifty years on, important questions are now being raised about the viability of air travel in the long term. High levels of environmental pollution from aircraft emissions during flight and the environmental impact of the growth of airports in densely populated areas are only two of the issues that are becoming a cause for concern. Creative thinking is required to find ways of dealing with both of these issues.

INTRODUCTION

In this chapter we first review the changing times and look at the impact it has on us and on the need for creative thinking. Next we review definitions of creativity and highlight the importance of creative problem solving in assisting business executives to get to grips with novel or new problems. Next we distinguish creativity from innovation. Creativity in business is extremely important since it is the means of generating new ideas that are required to deal with previously unmet situations. It also gives businesses a competitive edge in the market place enabling them to survive and even stay well ahead of competition. We pick out those instances where creativity is most needed and noting, in particular, the phenomenon of paradigm shift. Paradigm shift occurs when a totally new way of doing things becomes universally adopted. This chapter sets the scene for the next chapter where we discuss some of the blocks people may encounter in coming up with ideas and how these blocks may be overcome.

CHANGING TIMES

The first few years of the present century saw technology advancing in line with that experienced during the last years of the twentieth century. The trend has continued but alongside the prominence of technology in creating change economic, political and social pressures have come to dominate the scene. In the past few years the latter have begun to produce problems that are difficult to solve. In business there is need to obtain insights into such problems. Questions such as ‘How does one stimulate growth in sales and profits when there is no growth to be had?’ may be at the back of managers’ minds. Or even, ‘How can we ensure that the business will survive?’ They cannot, however, assume, like Dickens’ Wilkins Micawber that ‘something will turn up’. Challenging assumptions is at the heart of creative problem solving.

In Chapter 2 of this book we will examine the reasons why people have difficulty in challenging assumptions and thinking in a creative manner about such problems. In Chapter 5 we will explore this topic further and see how and why people have different approaches and preferences to thinking and how this can impact on their approach to finding solutions to some kinds of challenging problems. Of course, it is helpful to understand something about how people get ideas and how this can be encouraged in individuals and organizations. In Chapters 3 and 4 we look at the theoretical ideas relating to creativity and creative problem solving. The techniques sections of the book are intended as guides to help people generate ideas. Of particular interest may be Chapter 11, which features paradigm breaking approaches and comments on the positive and the negative consequences of disruptive technology.

Evaluating and implementing ideas is perhaps the hardest part of the creative problem-solving process. Ideas arise sequentially and what we determine to be the best idea today we may not prefer tomorrow. In addition, just how certain can we be that our judgements are sound? Are we really using the right criteria by which to judge ideas? When it comes to implementing ideas the situation is equally obscure. Moreover, it is all well and good coming up with what seem to us to be good ideas, but will those who have to put the ideas into practice hold the same views?

Technology marches steadily onwards developing new, more powerful and convenient devices to improve people’s lives both inside and outside of work. The Internet has grown like some giant spider’s web across the vast emptiness of hyperspace providing hubs of activity for social and business networking and exchange of communications. It provides a mechanism for the exchange of creative ideas and insights into intransigent problems. At the same time technology has not stood still in developing more convenient and sophisticated personal computers and communication devices. Apps are one of the buzzwords of the day and they abound in huge numbers, some even facilitating the use of creative problem-solving techniques. These are all developments that we will examine in Chapter 15.

Let us now turn to look at creativity and how people have tried to define it.

SOME DEFINITIONS OF CREATIVITY

What is creative thinking?

Creativity is a concept that we often come across in our everyday conversation. We hear of creative people, admire creative objects of art or read creative books. Yet, despite our almost innate understanding of what it means to be creative, there is much confusion about the nature of creativity.

Wertheimer ([1945] 1959) suggested that creative thinking involved breaking down and restructuring our knowledge about something in order to gain new insights into its nature. Understanding our own cognitive model of reality may therefore be an important determinant of our ability to think creatively. Kelly (1955) and Rogers (1954) both supported this argument by maintaining that we can be creative by gaining an understanding of how we think about a subject. Creativity is something that occurs when we are able to organize our thoughts in such a way that readily leads to a different and even better understanding of the subject or situation we are considering.

Maslow (1954) thought of creativity as having two levels. He envisaged primary creativity as the source of new discovery, real novelty, or ideas that depart from what exists at a given point in time. He saw secondary creativity as a characteristic possessed by many scientists in their collective search for discovery achieved by working alongside other people, extending the work of previous researchers, and exercising prudence and caution in their claims about new insights or ideas. He envisaged creativity as an aspect of human nature that was to be found universally in all human beings. In children he felt it to be an easily observable phenomenon but suggested that it seemed to become lost in adults, surfacing mainly in dreams with the relaxation of repressions and defences. It was a view that was echoed subsequently by Stein (1974), who argued that without such an assumption the techniques for stimulating creativity would have no application.

Torrance (1965) defined creativity as:

The process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solutions, making guesses or formulating hypotheses about the deficiencies; testing and retesting them; and finally communicating the results.

This contrasts with that of Newell *et al.* (1962). They adopted a criterion-based approach, which suggests that any problem solving may be creative. Indeed, Haefele (1962) argues that every one of us must be creative to some degree because we have to find new solutions to newly presented problems.

Rickards (1985: 5) defines creativity as ‘the personal discovery process, partially unconscious, which leads to new and relevant insights’. Rickards (1988: 225) also advocates a view of creativity as a universal human process resulting in the escape from assumptions and the discovery of new and meaningful perspectives, or as an ‘escape from mental stuckness’. In broad terms he believes that creativity is to do with personal, internal restructuring.

Creativity is very much concerned with how we imagine things. Although language is a medium of expressing our creative feelings, our creativity is often gained through images and

sensations that are difficult to express in words. As Koestler (1964) said: ‘True creativity often starts where language ends.’

Weinman (1991) considered that creativity is the ability to go beyond the mundane and obvious and reject the traps of repetition and pre-set categories. Similarly, Gilliam (1993) defined creativity as a process of discovering what has not been considered – the act of making new connections.

More simply, creativity can be thought of as ‘the production of novel and useful ideas in any domain’ (Amabile *et al.*, 1996: 1155) and in a business context: ‘creativity is the production of new ideas that are fit for a particular business purpose’ (Pryce, 2005).

Parkhurst (1999) points to the lack of consensus regarding the definition of creativity but that many researchers agree that creativity may be defined with regard to the terms ‘new and useful’ (Mumford, 2003), which suggests that a creative product is that which is deemed to be novel or original and useful or adaptive (Batey, 2012).

These various definitions seem to agree that creativity involves an ability to come up with new and different viewpoints. However, any definition of creativity is complicated because the concept is multifaceted.

INVENTION AND CREATIVITY

Invention is an act of creativity that results in a device, process or technique that is novel enough to produce a significant change in the application of technology. The application of creativity is fundamental to invention. The element of novelty has various forms; it may be a new device or process, or even material, but it may also consist of a combination of existing knowledge in a manner not previously considered. For example, James Watt added a separate condensing chamber – a new device – to Thomas Newcomen’s atmospheric engine and created the steam engine.

We need to differentiate between invention and innovation. One may look on invention as the formulation of new ideas for products or processes, whereas innovation concerns the practical application of new inventions into marketable products or services.

It is also useful to differentiate between two types of innovation:

Product innovation: this comprises changes to attributes of product, resulting in a change in the way the product is perceived by consumers – for example, wireless connectivity to the Internet as opposed to access by cable.

Process innovation: this relates to changes to a service or product production process. It usually produces benefits in the production process, i.e. increase in productivity and cost reduction – for example, emails compared to mail delivered through the postbox.

From a business development point of view and in terms of developing growth strategies it is suggested that breakthrough innovation should not be the focus of attention. Indeed, the latter strategy may be too radical for some markets (Treacy, 2004). Evidence points to over 90 per cent failure rate among new products launched into the marketplace and that the majority of these were based on radical technologies (Christensen *et al.*, 2005). Such evidence

PRODUCT INNOVATION

Digital camera

Not that many years ago, amateur photographers zealously guarded their 35mm cameras. They took them everywhere when going on holiday and some even engaged in home printing of coloured photos when they got back home. To get really good photos required a great deal of skill. Given the cost of prints and film it could be an expensive pastime, too. One might expend a good deal of time, effort and money just to get a few really good photos.

The advent of the digital camera has changed nearly all that. Skill is still required to get really good photos, but cost and time have been reduced very substantially to do so. The modern digital camera enables us to take a photo and print it out on our computer at home in a matter of minutes. The cameras also offer many more features and cost much less than the 35mm ones did just ten years ago.

Process innovation

How many examples of process innovation can you think of? Here are four for a starter:

- 1 Introduction of a bar-coded goods-tracking system.
- 2 Introduction of GPS tracking devices for transport services.
- 3 Implementation of computer-assisted design for product development.
- 4 Implementation of a new reservation system in a travel agency.

indicates that, in order to remain competitive, organizations should seek to develop new products via incremental technologies (Moon, 2005). Adopting a process of continuous improvement to existing products appears to be a requirement of continued success (Randal *et al.*, 2005). Adopting such a strategy involves the redesign of existing models/products with incremental technologies and it produces cost savings in terms of time and money and may lead to retention of existing customers (Treacy, 2004). Innovative technologies and tools were crucial for Google to become the world's most popular search engine and a robust financial enterprise with its market value continuously rising (Vise, 2005).

The two general theories of invention are the *deterministic* and the *individualistic*. The deterministic theory holds that when economic, technical and cultural conditions are ripe, an invention will be made by one inventor or another; who does it is just historical accident. This theory has some support in the numerous instances of simultaneous and independent invention. It also helps to explain the competing claims that emerged over the invention of the steamboat, the electric telegraph, the incandescent lamp and the aeroplane. The theory is also plausible because timing is unquestionably important in invention. Also, inventors are likely to focus on projects that are reasonably attainable and for which there is a recognizable need or demand.

INVENTIONS, INNOVATIONS OR JUST CREATIVE RESEARCH?

Gene research

In 1988, Rudolf Jaenisch and co-workers succeeded in implanting in mice the gene for a hereditary disease of humans. It was thought that it would open the way to the study of such diseases and to improved treatment.

Superconductors

In 1911, Heike Onnes discovered that electrical resistance in mercury disappears when the mercury is cooled to absolute zero. This phenomenon is known as superconductivity. It was found subsequently that other metals and alloys also become superconducting at very low temperatures. Today, superconductors are used in large and powerful magnets, mainly in particle accelerators and the magnetic-resonance imaging machines used in medicine. There are other potential applications.

Infinity of non-smooth four-dimensional spaces

In 1987, Clifford Taubes discovered that the infinity of non-smooth four-dimensional spaces is uncountable (an infinity is countable if each element in it can be matched to one of the counting numbers).

Quarks

When physicists first began to think deeply about quarks they were puzzled because isolated quarks had not been observed. One idea was that quarks might be the ends of strings. Assuming that a particle was a string and that quarks were just the ends of the string, then it was plausible why one never found a quark without the other. A string is essentially a one-dimensional object in a space of four dimensions (counting time as a dimension). Physicists turned to topology, the mathematics of knots and surfaces, to find out what the implications might be of using strings instead of particles in their calculations. To their surprise, they discovered that strings simplified the calculations.

Question

How would you classify each of the above four illustrations in terms of inventions, innovations or just creative research?

THE IMPORTANCE GIVEN TO CREATIVITY IN BUSINESS

In management, problems arise as different or new situations present themselves and they often require novel solutions. Frequently, it is difficult to see solutions to problems by thinking in a conventional fashion. Logical thinking takes our existing knowledge and uses rules of inference to produce new knowledge. However, because logical thinking progresses in a series

CREATIVITY AND INVENTIONS

Christian Doppler gave his name to a well-known principle which he discovered in the nineteenth century (the Doppler effect). We can observe it any time a motorist sounds his or her horn while passing us by. As long as the source of the sound approaches us, the pitch seems higher than when it moves away from us. Sound waves are just one form of wave subject to this effect.

Can you think of how twentieth-century inventors might have made use of this principle to come up with commercially applicable inventions?

See Appendix 2 for the solution.

of steps, each one dependent on the last, this new knowledge is merely an extension of what we know already, rather than being truly new. It would seem, therefore, that logical thinking has only a limited role to play in helping managers to be creative. The need for creative problem solving has arisen as a result of the inadequacies of logical thinking. It is a method of using imagination along with techniques that use analogies, associations and other mechanisms to help produce insights into problems.

Over the past few decades creativity has become a highly fashionable topic in both the academic and business worlds. That is not to say that creativity did not exist before, but its importance to the continued success of an organization had yet to be recognized. Many management problems require creative insights in order to find satisfactory solutions. Nowadays, the majority of organizations are fully aware of just how vital creativity is to their prosperity. Over time, considerable research has been undertaken that enables us to obtain a better understanding of creativity and become more innovative ourselves.

Change is an ever-present phenomenon to which businesses of all kinds are forced to respond if they want to stand the best chance of survival and prosperity. But how should they respond? An increasing number of problems have no precedents, and there are fewer tested ways of approaching them. This poses problems for organizations. Many suggest that creativity is indeed the answer; and, as Majaro (1991: 1) suggests, 'It is universally assumed that enhanced creativity can provide a company with a competitive edge'. A survey sponsored by Porter/Novelli among 100 executive readers of *Fortune 500* in 1993 found that people thought creativity was essential to ensure success in business. The finding has been reiterated several times since in different sources (De Brabandere, 2005; Gogatz and Mondejar, 2005).

A plethora of literature has emphasized the need for creativity in business. Indeed, Oldman and Cummings (1996: 609) noted that 'numerous commentators have argued that enhancing the creative performance of employees is a necessary step if organisations are able to achieve competitive advantage'.

There are strong arguments to support the view that in the second decade of the twenty-first century the competitive marketplace demands ever-increasing value to customers, which translates to lowest total cost, highest total quality, fastest total cycle time, and highest total

AN ECONOMIC CLEANING JOB: FINDING A LESS COSTLY WAY OF PERFORMING A TASK

Tank Refurbishers clean out and reline industrial storage tanks. In an increasingly competitive market, margins are becoming tighter and profitable business ventures more difficult to find. Nearly all the tanks the firm refurbishes are cylindrical and vary considerably in terms of the volume of liquid they contain. The procedure is to remove the ends, clean and repaint the inside of the cylinder, clean and repaint the end sections and reweld the pieces after completion of the repainting.

How might the firm seek to be more competitive in the pricing of its jobs?

See Appendix 2 for the solution.

overall customer satisfaction (Atkins *et al.*, 2002). This in turn supports the argument that there is a need for creative continuous innovation. In a globally competitive environment where firms compete on both quality and cost, then the means of improving operating procedures and achieving cost reductions also demands creative thinking. As global competition intensifies, creativity helps to establish and maintain a competitive advantage (Meisinger, 2007).

Why is creativity in management important? The main problem in management, according to James March (1988), is that: 'Organisations face a large number of problems of about equal importance, but only a few solutions. Thus the chance of finding a solution to a particular problem is small.'

In order to identify and so solve many of the problems that arise in business it is necessary to challenge the problem-solving capabilities of those in charge. In many cases the creative process that is used to approach problems has to be restructured and redeveloped in order to produce new ideas and perspectives.

Change is an intrinsic necessity for a company that wishes to perform well in the long term. As John Harvey Jones stated: 'Unless a company is progressing all the time, it is in fact moving backwards. It is quite impossible to maintain the *status quo*' (Rogers, 1996). Attempting to do things in the same way as they have always been done in the past can lead to difficulties in a business environment that is experiencing rapid cultural, economic or technological change. Change is an ever-present phenomenon to which businesses of all kinds are forced to respond if they wish to stand the best chance of survival and prosperity.

The rapid growth of competition in business and industry is often quoted as a reason for wanting to understand more about the creative process (see, for example, Van Gundy, 1987; Rickards, 1990). Many firms are continually experiencing pressure to enhance old systems and products. Growth and survival can be related directly to an organization's ability to produce (or adopt) and implement new products or services, and processes (Van Gundy, 1987). One of the key aspects of any organization's success or failure is its ability to stay ahead of the competition in a rapidly changing environment. The modern business, with its emphasis on

competition, building larger markets, strategic planning, team working, etc., has created the need for new problem-solving and decision-making strategies.

Looking at the British economy, for example, there has been repeated criticism of the comparative lack of innovation in British manufacturing. Porter and Ketels (2003) argue that managers in British firms are slow to adopt new management techniques, attributing this to a combination of low investment in new technology, and to weak employee training and development policies. They argue that a renewed emphasis on skills development, enterprise and innovation is necessary if the British economy is to remain competitive.

Another reason is that managers need to discover new and better ways to solve problems (Ackoff and Vegara, 1988). In particular, an increasing number of problems have few or no precedents, hence there are fewer tried and tested ways of approaching them with the anticipation of reaching a successful outcome. To stay in business a company has to respond creatively to the problems it faces. Problems may exist in both the external and internal environments. The former poses problems such as how to cope with slow economic growth, how to deal with new entrants to an industry, how to grow sales at the pace of competition in high-growth markets, how to deal with new technological developments and how to cope with shorter product life-cycles. The latter poses problems to do with poor internal communications, financial problems, alienated or poorly motivated staff, and inadequate planning.

Changes within a company, forced by either internal or external factors, create an unhappy climate for the company and its workers. Management needs to respond positively to such situations. Creativity is considered to be a vital asset for any person who is in a leadership role (see, for example, Bennis and Nanus, 1985; Ekvall, 1988; Banks and Winston, 2008; Carr, 2010). Creative leaders actively hunt for new problems and are especially successful in handling new challenges that demand solutions outside the routine of orthodox strategies. They often possess significant vision and are able to inspire others by their creative talents.

It has been argued that creativity is an important human resource (Barron, 1988) which exists in all organizations. Organizations have to try to make use of this resource by devising settings that permit creative talents to thrive. Employees' expertise and skills are an important asset in a knowledge-based economy, and have positive impacts on growth and jobs in the economy. Of particular importance are those that produce, adapt and diffuse new technical knowledge. Successful innovation depends on the ability to mobilize technical resources, knowledge and other inputs needed in the innovation process. This includes sources of knowledge, such as networks of firms, concentrations of research and development (R&D) and business services. When this is available, it enhances the ability to innovate. The interface between science and society provides a platform for increased competitiveness. It permits knowledge transfer mechanisms that bring knowledge to the market as commercialized products.

HOW CREATIVE THINKING MAY BE USED IN MANAGEMENT

Creative thinking benefits all areas and activities of management. It is required to dream up better ways of marketing goods, to devise new production methods, to find new ways to

ILLUSTRATIONS OF HOW CREATIVITY MAY BE USED IN MANAGEMENT

- To make more effective use of a manager's time
- To improve a product's appeal to customers
- To improve motivation among staff
- To appeal to customers' wants and needs
- To cut costs through more efficient/effective production methods
- To identify new and profitable product-market opportunities

motivate people, and so on. Creativity turns up in every business situation where there is a chance that things can be done in a more businesslike, more profitable or more satisfying way.

The following are typical of the kinds of problem that require creative thinking:

- How to make more effective use of a manager's time.
- How to improve a product's appeal to customers.
- How to improve motivation among staff.
- How to appeal to customers' wants and needs.
- How to cut costs through more efficient/effective production methods.
- How to identify new and profitable product-market opportunities.
- How to get skilled and experienced staff to stay with the company without paying them excessively high salaries.

Problems that require creative thinking are 'open-ended' problems – that is, problems for which there is more than one solution. Executives have to make decisions that require creative problem solving in planning, organizing, leading and controlling their organizations:

Planning

- Determining the mission of the organization.
- Determining the organizational objectives.
- Identifying strengths, weaknesses, opportunities and threats.
- Adjusting the organization behaviour and strategies to competitors' strategies.
- Deciding how to implement competitive strategies.

Organizing

- Deciding what jobs need to be done within an organizational unit.
- Deciding how various jobs within an organizational unit can be grouped together, etc.
- Deciding how much authority should be delegated to various organizational positions.
- Determining how best to train people for their jobs.

Leading

- Finding ways of increasing productivity in the workplace.

Controlling

- Deciding what systems of control are needed.
- Setting standards.
- Identifying why standards/objectives have not been achieved.

Formulating strategy is another area that can benefit from creative thinking. Mintzberg (1987) identified five activities that describe the strategy process:

- 1 goal/objective setting;
- 2 analysis (internal and/or external);
- 3 development of strategic alternatives and selection;
- 4 implementation and evaluation.

He went on further to advocate the value of *mental models* in decision making. These models represent commonly held understandings that define the logic of a system and incorporate rule-like generalizations about what will and what will not work in a particular system. While rule-based mental models no doubt can aid problem solving, one should challenge the assumptions upon which they are predicated in the event they cease to provide pathways to solutions. Indeed, challenging assumptions is fundamental to creative thinking.

Morecroft (1992) argues that strategy support tools are useful in terms of helping managers visualize strategy and its implications. In this latter context Tan and Platts (2003) found support for the visualization of complicated analysis as an aid to decision making. Furthermore, Dyson *et al.* (2007) argued that strategy tools can be used within the strategy development process to ‘rehearse strategy’ and facilitate creating and testing strategic initiatives, instead of ‘*passively awaiting feedback signals that implementation is off course*’.

The environments in which organizations operate produce both opportunities and threats. Organizations bent on survival and success in the dynamic business environment need to use suitable management tools that can identify emerging issues that are important for their businesses. If the cumulative changes in the economic, technological, social, political and cultural environments remain unnoticed by a company’s managers until it is too late to respond, the problems they create may be insuperable (Large, 1992).

Greater environmental turbulence, particularly economic uncertainty, demands that new ways of thinking and behaving are required to enable businesses to survive (Rundh, 2007). In particular, innovation is a key differentiator between successful and unsuccessful firms in difficult environmental conditions (Tellis *et al.*, 2009). Rundh (2007) argues that to be successful, a company should react quickly to the changing market environment and improvisation enables this (Moorman and Miner, 1998) (see Chapter 4).

CONDITIONS IN WHICH CREATIVE THINKING IS NEEDED MOST

It is argued that in an organizational sense creative thinking is required most when there is a lack of consensus regarding goals and also a lack of understanding about cause–effect relationships (Thompson, 1967). Disagreement often occurs when problems arise that have not been previously encountered, and when outcomes and goals are uncertain.

CREATIVITY IN ACTION

Who could have envisaged fifty years ago the retail development complexity of travel agents or the shopping complexes at airports such as London Heathrow, London Gatwick, Manchester International, Amsterdam, Kuala Lumpur, Munich, Madrid and Barcelona – to mention just a few. Indeed, some of the major airport complexes have developed almost into miniature shopping centres in their own right. The planners of such development complexes continue to exercise their creative problem-solving skills in order to find more ways of satisfying their customer en route to various destinations.

The airlines themselves have become more creative in their thinking and in the way in which they approach problems. Not everyone, however, is always happy with the outcome of such creativity, as was evidenced in the reaction of some distinguished members of the public to the novel tailfin logo adopted by British Airways in 1998. In recent years airlines have come to pay more attention to the logo on their aircraft, seeing it as an important way of portraying their brand image.

Traditionally, Air Canada planes were white with bright red lettering and a big red maple leaf on the tail. However, research showed that the strong image was a real problem with Canadian users because of its association with government bureaucracy. Apparently, Canadians adore Canada but are much less favourably disposed to its government. Canadians tend to attribute a host of hearth-and-home values to themselves and their country: compassion, friendliness, a progressive outlook and a law-abiding nature. It was decided to emphasize these associations while de-emphasizing the government part. The maple leaf was kept but it was rendered in a more natural earthy red on a new evergreen tail – the reasoning being that the stark red-on-white contrast was too much associated with the government image. The overall effect makes the new planes look a lot less like flying Mounties.

British Airways, too, has had its dose of creative thinking. It was revitalized by Sir Colin Marshall in the 1980s with a particular directive to focus on the customer. An effective internal marketing programme was based on the notion that employees would not treat customers better until they themselves were treated better. Marshall established profit sharing and a two-day seminar at which attendance was compulsory for all employees. The seminar focused on all relationships that employees might have with other employees, bosses, customers or even family members. It was felt that the programme contributed significantly to raising staff morale and to better customer relations. Among the creative ideas to emerge was the installation of TV cameras in passenger disembarking areas, enabling them to register complaints immediately on landing. These are then dealt with in a timely manner, and the customer is informed of what action has been taken.

Changing the image of British Airways was also something to which attention was given. New uniforms for staff, new exterior paint on planes, new interiors for planes, new passenger lounges and an expensive advertising campaign were employed to promote the new image of British Airways. The airline business is immensely

competitive, and all companies have to strive to find ways of identifying means of establishing a competitive advantage for themselves. This is often sought by trying to improve the quality of service offered in relationship to the price charged or through the nature of the augmented service offered.

Service quality includes such things as:

- 1 *Tangibles*. Do the physical facilities, equipment and appearance of personnel associated with the service promote confidence in the quality of the service?
- 2 *Reliability*. Is there evidence of an ability to perform the promised service properly the first time?
- 3 *Responsiveness*. Is there a willingness to help customers and provide prompt service?
- 4 *Competence*. Do the personnel possess knowledge and skill, and have they an ability to convey trust and confidence?
- 5 *Credibility/trustworthiness*. Is the organization trustworthy and does it always deliver what it promises to deliver?
- 6 *Empathy*. Does the provider of the service provide its customers with individual attention?
- 7 *Courtesy*. Do customers perceive the service provided to be a friendly one?
- 8 *Communication*. Are customers kept informed about the service offered in the language they can understand? Do the providers of the service listen to what the customers have to say?

The augmented service refers to activities or additional services that are tangential to the physical transportation of customers from the point of departure to their destination.

Question

In what ways might airlines offer an augmented service to customers? Can you think of any that are not currently offered?

Such is the nature of the situation created by environmental turbulence that it has been used as a creative force for change. A research project (Martin *et al.*, 2005) on the changing nature of leadership showed 84 per cent of the 300 executives and senior managers surveyed believed that the definition of effective leadership had changed in the previous five years as business challenges grew more complex.

Palus and Horth (2002) argued that managers need to scan information quickly and make rapid judgements. They observed that when managers are faced with a complex problem, they tend to spend only 10 per cent of the available time examining a problem and its context, while 90 per cent of their time is spent on generating a solution. Perhaps not surprisingly, the result is that managers often end up solving the wrong problem. Palus and Horth (2002) suggest several approaches for breaking free of our habitual ways of seeing in order to become innovators:

- Alter perspective radically by changing one's point of view.
- Ask for the opinions of others and collaborate with others who have the skills and perspectives one lacks.
- Use questions to take aim at the root of the issues faced.
- Spend time among customers, constituencies and competitors to gain new perspectives.
- Keep track of ideas.
- Change the pace of attention to information and knowledge acquired.

These and other suggested approaches are considered in later chapters of the book.

The need for creative thinking often becomes paramount when *paradigm shift* occurs or is likely to occur soon.

PARADIGM SHIFT

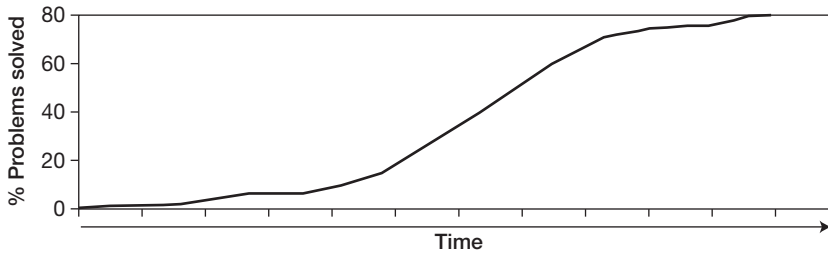
Kuhn (1970) defined and popularized the concept of 'paradigm shift' (p.10). Kuhn argued that science does not evolve, but rather it follows a 'series of peaceful interludes punctuated by intellectually violent revolutions', and in those revolutions 'one conceptual world view is replaced by another'.

A paradigm is a set of rules and regulations that define boundaries and help us to be successful within those boundaries, where success is measured by the problems solved using these rules and regulations. Paradigm shifts are different from continuous improvement. Examples include going from donkey cart or horse-drawn carriage to car, or travelling long distances by aeroplane instead of by bus or ocean liner. Paradigm shifts have made it possible to send complex, accurate messages over great distances; they have facilitated moving from primitive methods such as shouting, smoke, fire, drum and flag signals, to highly sophisticated mechanisms such as telegraph, telephone, fax, live video by wire, optical fibre and communications satellite.

Paradigms have life-cycles, and towards the end of the life-cycle problem solving becomes more costly, more time-consuming and less satisfactory (Figure 1.1). Solutions no longer fit the larger context because of changes that have occurred elsewhere. Nowhere is this better illustrated than in the case of needing to improve parts of the UK motorway network. Widening sections involves not only millions of pounds of taxpayers' money, but also places an additional unestimated burden on motorists in terms of long delays, excessive fuel consumption while negotiating the sections involved and psychological stress, which is difficult even to estimate. The paradigm of widening busy stretches of motorways must surely be in the decline stages of its life-cycle. A paradigm shift is required urgently.

Towards the end of the life-cycle, problem solving becomes more costly, more time-consuming and less satisfactory. Solutions no longer fit the larger context because of changes that have occurred elsewhere.

Paradigm shifts require a change in perspective on the subject. Blinkered thinking associated with holding too rigorously to a paradigm can lead to missing opportunities and overlooking threats that may have a critical impact on a business. Two competitors may see the same opportunity or threat in different ways, and the one that is able to make the best response can gain a sustainable competitive advantage over its rival.



Towards the end of the life-cycle, problem solving becomes more costly, more time-consuming and less satisfactory. Solutions no longer fit the larger context because of changes that have occurred elsewhere.

Figure 1.1

Paradigm life-cycle curve

The process of paradigm shift can be encouraged and effected early through the use of creative thinking. Creative thinking brings into place notions and ideas that would not normally be contemplated in problem solving. Creative problem-solving methods make extensive use of techniques and approaches that help to find solutions to recalcitrant open-ended problems.

The ability to tolerate ambivalence between opposites or two incompatible subjects is thought to characterize highly productive creative thinking. Edison's invention of a practical system of lighting involved combining wiring in parallel circuits with high-resistance filaments in his bulbs, two things that were not considered possible by conventional thinkers at the time. Because Edison could tolerate the ambivalence between two incompatible things, he could see the relationship that led to the breakthrough.

QUESTIONS

- 1 Why should the modern-day manager need to know about creative problem solving?
- 2 Why is creative problem-solving expertise an important asset for any business executive?
How might executives improve their creative problem-solving skills?
- 3 What is paradigm shift? How does it relate to creative problem solving?
- 4 What kinds of surprises do you think the twenty-first century might have in store for us as: (a) workers, (b) consumers, (c) producers, (d) managers?
- 5 Koestler said: 'True creativity often starts where language ends.' How would you interpret this statement in the context of business?
- 6 If we tend not to think about what we think we know already, and existing ideas tend to make us myopic about new possibilities, how can we hope to get new insights into existing problems?
- 7 James March argues that 'Organisations face a large number of problems of about equal importance, but only a few solutions. Thus the chance of finding a solution to a particular problem is small.' Does this mean that organizations must spend most of the time 'muddling through'? Why or why not?

- 8 Growth and survival can be related directly to an organization's ability to produce (or adopt) and implement new products or services, and processes (Van Gundy, 1987). How does one reconcile this suggestion with the fact that many products appear to have been around for many years (e.g. Mars Bar) while others enjoy a revival (e.g. the Volkswagen Beetle car)?
- 9 Why should lack of agreement regarding goals and a lack of understanding of cause–effect relationships give rise to a need for creative thinking?
- 10 Differentiate innovation from creativity and invention.
- 11 Why might many firms prefer an incremental rather than a breakthrough approach to innovation?
- 12 What factors contribute to a lack of innovation in an industry?
- 13 Indicate what you think are the main drivers of successful innovation.
- 14 'Creativity is not just for problem solving. Very often the most powerful effects of creativity are seen when we challenge existing ways of doing things that are very satisfactory' (de Bono, 2006). – 'Thinking Managers', available at: www.thinkingmanagers.com/management/creativity-management.php, accessed 9 April 2013. Discuss.

CASES

Game Enough

Game Enough recently reported a very substantial trading loss for the past twelve month's operations. The loss amounted to some £185 million and, as a result, the company reckons it will have to make some 10 per cent of its workforce redundant. The top management in the company places the blame firmly at the feet of deteriorating worldwide economic conditions and a very uncertain outlook for the future.

The company has enjoyed rapid growth over the last decade and found it easy to make money in a market where *variations on a theme* have been very much the name of the game. It has been a 'me too' attitude where anyone who can find some new narrative for an 'old theme' can make a quick profit. Characters and plots abounded and the same basic mechanics in constructing games and controlling game play have been employed in a seemingly endless fashion to tempt would-be gamers into parting with their cash. Sales of the firm's games have multiplied from small beginnings in a rapidly developing home market to multi-million pound global sales.

The latest loss has come about as something of a surprise to a company that has traditionally been earning big profits, and the Chairman of the Board of Directors and Chief Executive are having discussions about what action they should instigate. The Chief Executive blames a worldwide economic recession and argues that it is simply a case of 'weathering the storm'. A leaner organization, he argues, will be better able to come out of the recession fitter and able to take advantage of the recovery that will ultimately come about. The Chairman, on the other hand, is less convinced with this argument and feels that there are problems in the industry as a whole. He is influenced in his view by the opinions of several of the non-executive directors of the Board who have wider experience of what happens in other industries.

Question

What do you think are the main reasons behind the firm's demise? Can it do anything about the situation? Explain.

Keeping prices competitive

John Holmes operates a clothes wholesale distribution business. Competition is strong and pricing is keen. Rising costs of distribution, however, are a constant problem, and all rival distributors compete strongly on price. John is looking for ways of keeping prices competitive.

Question

How can John try to minimize price rises in the face of strong competition and at the same time still maintain profitability? (See Appendix 2 for some suggestions.)

Price and innovation

Sally Major owns a hi-tech company that produces assembled and part-assembled components for a variety of industrial and consumer goods. Recently, the technical department has achieved a major breakthrough in the production process that enables the firm to reduce the cost of producing all component assemblies and subassemblies by at least 50 per cent. As a general guideline to setting prices the firm usually adopts around a 100 per cent mark-up on the costings subject to this, making the product competitive in the marketplace. Occasionally, where demand is high and there is no price consciousness, mark-up can be at least 150 per cent and still be in line with what competitors are charging for similar products. There are only a handful of products where mark-up is less than 100 per cent and none where it is less than 80 per cent. In all cases, the firm makes sure that its pricing is in line with that of competitors. The firm adopts the role of market-challenger in all market segments. Market share varies from between 25 per cent and 40 per cent of the market segment.

Question

What action do you think Sally should now adopt with respect to pricing? (See Appendix 2 for comments.)

Paradigm shift***Paradigm shift in business strategy***

In the new world of business, instead of long-term prediction, the emphasis is on understanding the multiple future worldviews by using techniques such as scenario planning. In this view, the organization plans for its futures, but does not rely on its plans.

Paradigm shift in design and use of technology

This involves the shift from the traditional emphasis on transaction processing, integrated logistics and workflows to systems that support competencies for communication building, people networks and on-the-job learning.

Paradigm shift in the role of senior management

It has been suggested that the role of senior management needs to change from *command-and-control* to *sense-and-respond*. The new emphasis should be on building *commitment* to organizational vision rather than on *compliance* to rules and pre-specified best practices. Senior managers need to view the organization as a human community capable of providing diverse meanings to information outputs generated by the technological systems. They also need to make the organizational information base accessible to organization members. This is important given the increasingly fast-paced and dynamic business environment that creates disconnects between the process of decision making at the top and implementation of such decisions at the grass-roots.

Paradigm shift in organizational knowledge processes

Institutionalization of 'best practices' by embedding them in information technology might facilitate efficient handling of routine and predictable situations. However, greater proactive involvement of human imagination and creativity is needed to facilitate greater internal diversity to match the variety and complexity of the changing environment. Often, effective knowledge management in such an environment may need imaginative suggestions.

Paradigm shift in organization design

While the traditional business logic was based on a high level of structure and control, the dynamics of the new business environment demands a different model of organization design. This model is characterized by relative lack of structure and lack of external controls. Differences in perspective may have a very positive role in innovation that feeds new product and service definitions and business models. This view encourages promotion of individual autonomy in experimentation and learning. Instead of emphasizing 'best practices' archived in databases, it encourages continuous pursuit of *better* practices that are aligned with a dynamically changing business environment.

Question

Examine the implications of paradigm shift in the above contexts from the point of view of creative problem solving. What kinds of problem might they raise for managers in the twenty-first century?

Oil crisis revisited

The oil crisis of the early 1970s brought to everyone's attention that sources of energy might not last for ever. One day the availability of oil seemed endless and cars buzzed tirelessly along the newly built motorways. The next day people were told that oil was a precious commodity that had to be conserved. Output in the principal producing countries in the Middle East was restricted to conserve supplies, a 50 mph speed restriction was imposed on the motorways and the price of oil rocketed on international markets. Businesses and private citizens felt the pinch on their pickets and inflation took on proportions that had not been seen for many years. Since that time the coming on-line of North Sea oil and the discovery of potential oil deposits in other areas has taken the sting out of the 'need to conserve' argument. Nevertheless, motor

vehicle manufacturers have taken note of the need to conserve and introduced more efficient engines and are actively researching for ways of improving fuel consumption requirements even further. There is also, of course, a drive towards finding viable alternative fuel sources, such as that provided by solar power and electrical battery power.

However, it seems inevitable that during the course of the next few centuries oil resources will eventually dry up. The resources are finite relative to consumption. It takes much longer for nature to create oil resources than it does for the human race to consume them.

Question

Imagine the time when oil eventually runs out. What will be the implications of a world without oil? What substitutes need to be found that will provide for the myriads of uses of oil – quite apart from fuel and lubrication for the petrol engine?

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Blocks to creativity

Ford Model 'T' car: the mindset of Henry Ford

Henry Ford's model 'T' remained unchanged for years while General Motors (Chevrolet) was making changes – often using new technology. Henry Ford said: 'We'll give the customer any colour he wants as long as it is black.' It was a statement by a man who had been on top so long he thought nothing could dislodge him from that position. He did not perceive the effects that the changing environment would have on customers' wants and needs, and in particular on their requirements in terms of the motor car. Increasing consumer affluence, which developed as the American economy grew in the early part of the twentieth century, meant that people had more disposable income and hence more capacity to exercise choice. General Motors recognized this, but Ford did not. In the late 1920s Ford nearly went out of business as a result of this myopic approach. General Motors (Chevrolet) took over as number one in the USA, and Ford did not catch up until the late 1980s. Ford's ability to exercise creative thinking was impeded by at least two blocks to creativity: inappropriate perceptions and negative mindset.

INTRODUCTION

Creative thinking and problem solving do not necessarily come naturally to people. In the case of individuals there are blocks to creative thinking and creative problem solving. The blocks are essentially of two varieties: individual and organizational. First, we examine the need to be ready for change and the need to deal with new kinds of problem. Then we turn our attention to the various personal blocks that people may encounter when trying to solve problems, think creatively and deal with new kinds of problems. These blocks are to do with mindset and with factors to do with perception, emotion, expression and cultural influences. The chapter then continues by discussing how these blocks can be diagnosed and overcome. We then move on to blocks encountered in organizations and the conditions under which creativity may be encouraged in organizations.

In Chapter 5 we will identify other kinds of blocks to creative thinking and in particular those that may be encountered when trying to use creative problem-solving techniques described in this book. Before that, however, in Chapters 3 and 4 we will look at some of the theoretical ideas about creativity and ideation. This will prepare us well for the subsequent material presented in Chapter 5.

THE NEED TO BE READY FOR CHANGE

Executives must be ready for anything that requires having the necessary tools to combat change proactively. As Morgan (1989) stated: ‘Many organisations and their managers drive toward the future while looking through the rear-view mirror. They manage in relation to events that have already occurred, rather than anticipate and confront the challenges of the future.’

If we were not at times ‘blocked’ in our thinking, we would not need creative problem-solving methods. In this chapter we will first consider the nature of problem solving within the information processing paradigm before going on to examine *individual* and *organizational* blocks to creative thinking. In addition, we will look at ways of dealing with both kinds of blocks. It is the existence of these blocks that gives rise to the need for a structured creative problem-solving process and for training to help overcome particular mindsets.

MINDSET

WHERE MINDSET EXISTS

- We have always done it this way. Why change?
- There can only be one way to do it properly.
- It’s experience that counts – it’s the only way to learn.
- I learned to do it this way and it has never let me down.
- Toy soldiers are for boys and dolls are for girls.
- Televisions are for receiving information – not for two-way communication.

Mindset is a condition where an individual is over-sensitized to some part of the information available at the expense of other parts. Mindset can be useful:

- It helps us to become sensitized to some important things and serves us well – for example, red lights act as warnings and alert us to impending danger.
- As a result of learning from experience, mindset sensitizes us to patterns that remind us of ways that have enabled us to solve past problems. We do not have to reinvent the wheel each time we encounter the same problem. For example, if when dealing with an irate customer we have found an approach that seems to be satisfactory from the point of view of dealing with the situation, when we subsequently encounter another irate customer we can deal with the situation using our acquired knowledge.

WHEN MINDSET BLOCKS US

Luchins (1942) showed how mindset under certain circumstances can produce fixation and stereotyping in problem-solving behaviour. The phenomenon may show itself under conditions where the individual has discovered a strategy that initially functions well in solving certain tasks but later blocks the realization of new and simpler solutions to similar problems. The effect reflects a dysfunctional consequence of the normal rational way of approaching problems that may block the establishment of a new perspective and more important lines of procedure in task environments that resemble those encountered before. Cyert and March (1963) observed similar behaviour among practising managers in real-life contexts. Typical managerial search is seen as simple-minded and as over-emphasizing previous experience by selectively searching in areas close to where previous solutions have been found.

Duncker (1945) investigated how past experience may block productive problem solving. He suggested the expression 'functional fixedness' to refer to a block against using an object in a new way that is required to solve a problem. Interesting real-life examples of functional fixedness are provided by Weizenbaum (1984). According to the latter, the steam engine had been in use for a hundred years to pump water out of mines before Trevithick had the idea of using it as a source of locomotive power – it had only been seen as a tool to help pump water out of mines. The computer had been used for a long time as a calculator before its use as a general symbol manipulator was envisaged.

It would seem that, while mindset can provide us with substantial benefits, unfortunately there are times when it can stand in the way of progress. Mindset can create difficulties for executives when they are facing new problems. When stuck on a problem, executives tend to follow their mindset, and this may be counter-productive as far as previously unencountered problems are concerned. Mindset is often characterized by one-right-answer thinking, always looking for reasons why something will not work and an over-regard for logical thinking.

Executives may have learned from past experience that a particular way of dealing with a problem usually leads to a satisfactory solution. Constant successful application of the approach reinforces the belief that this is the correct way to approach the problem, and even the *only* way to approach the problem. When a new problem arrives that defies solution by the learned approach executives becomes stuck and do not know what to do.

Negative or 'yes, but' thinking arises out of executives' zeal to cater for contingencies. It is only natural that they should try to ensure that any project will stand a good chance of being successful, and good management practice advocates that executives should consider what may go wrong and make contingency plans. Every suggestion is therefore questioned and critiqued in order to make sure that the risk of failure is minimized. However, the process of criticism itself can stifle creativity by inducing a negative mindset. Constructive criticism is required. Rather than make the comment 'yes, but' one should use the phrase 'yes, and'. For example, faced with the suggestion of making redundancies, the normal response might be: 'Yes, but that will only lead to unrest on the shop-floor and possible strike action.' The better response would be: 'Yes, and wouldn't it be useful, since we can then find other jobs for those people within the company.'

An over-regard for logical thinking can also create a barrier to creative thinking. Sometimes we have to take steps into the dark, as it were, based upon hunch or intuition. We may have

a feeling that what we are doing is the best course of action even though we cannot justify it in a traditionally logical way to ourselves. Perhaps the logical justification only becomes apparent *post facto* – we can see with hindsight that what we did was the right thing to do. Somehow we cannot perceive beforehand the logical justification – we have a perceptual block. The notion of perceptual blocks is discussed later in the chapter.

OTHER BARRIERS TO AN INDIVIDUAL'S CREATIVITY

Many researchers have attempted to address the phenomenon of barriers to creativity. These include Arnold (1962), Adams (1974), Jones (1987) and Majaro (1992). All have produced detailed lists of the various kinds of barriers to creative problem solving.

Some barriers limit individuals' creative output and are related to the people themselves. On the other hand, there are those that emanate from the environment in which people operate. Personal barriers may be subdivided into physiological barriers, such as the perceptual limitations of the senses or the brain's data-handling capacity, and psychological barriers related to the person's behaviour or attitudes.

Arnold (1962) suggested:

- 1 Perceptual blocks, which prevent a person receiving a true, relevant picture of the outside world.
- 2 Cultural blocks, which result from influences of society.
- 3 Emotional blocks, such as fear, anxiety and jealousy.

Adams added a fourth category: intellectual and expressive blocks.

Evidence also supports the view that creative thinking activities are affected by mood (e.g. Kaufmann and Vosburg, 1997). A positive mood facilitates creative problem solving (e.g. Forgas, 2000; Schwarz, 2000; Shapiro *et al.*, 2000) and recent theorists relate the state of happiness to creativity. Argyle (2001), Gasper (2004) and Myers (2002) have all argued that happy people feel relaxed and can generate many new ideas. Gasper (2004) also found that people in sad moods were more likely to use restraint when generating ideas, unless given specific instructions to compensate for the restraint. Indeed, mood, thinking and even personality may all be interrelated (Russ, 1999).

DEALING WITH AN INDIVIDUAL'S BLOCKS TO CREATIVITY

Jones (1987) initiated a study designed to find out more about the factors that inhibit creativity. In reviewing the literature on the subject he found that several authors included perceptual, cultural and emotional blocks within their taxonomies while others mentioned such factors as errors in thinking and personal fears. He identified four typologies of blocks. These were derived from cluster analysis of self-reported items. The typologies are:

- 1 *Strategic blocks*: 'one-right-answer approaches', inflexibility in thinking. These affect the approach taken to solve problems. They include the tendency to rely heavily on past experience or particular techniques without challenging their appropriateness; focusing

on a narrow range of options for either problem definition or problem solving; and adapting an over-serious approach to problems which prevents the emergence of a playful, imaginative and humorous climate.

- 2 *Value blocks*: ‘over-generalized rigidity influenced by personal values’. These occur when personal beliefs and values restrict the range of ideas contemplated. Values co-exist, and failure to reconcile them contributes to difficult personal and organizational dilemmas.
- 3 *Perceptual blocks*: ‘over-narrow focus of attention and interest’. These arise from a lack of sensory awareness at a physical level and therefore contribute to lack of awareness of implications of situations.
- 4 *Self-image blocks*: poor effectiveness through fear of failure, timidity in expressing ideas, etc. These reduce effectiveness in advancing ideas assertively. They arise from a lack of self-confidence in the value of one’s own ideas. Individuals may be reluctant to seek help and talk about personal feelings. This barrier seems to be the greatest impediment to the successful implementation of new ideas.

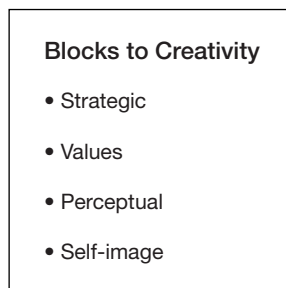


Figure 2.1

Jones's blocks to creativity

Jones's approach has resulted in training applications that centre on personal feedback and counselling, including suggestions for the most appropriate mechanisms for developing improved skills. Strategic blocks can be challenged through creative problem-solving training. Values, however, are a more difficult problem, but creating an awareness of personal values in the individual offers some respite. Perceptual blocks can be freed through observation, and self-image blocks can profit from assertiveness training. Creativity is a fragile business. It is stimulated by the right environment, self-image and co-workers; it is inhibited by limiting beliefs, work situations and stresses. Awareness of the obstacles to creativity can help us push through our creative blocks.

Perceptual block

Look at the statement in Figure 2.2. How many times does the letter 'f' occur? See Appendix 2 for the answer.

Perceptual block

Following the sinking of the old frigate *Ferdinand*, Nelson fought his way carefully around the cape in foul weather in the hope of meeting his foe again off the far side of the island. By the close of the day he found his adversary adrift and floating perilously close to the infamous granite rocks.

Figure 2.2*Perceptual block***DIAGNOSING WHETHER SOMEONE IS BLOCKED IN THEIR THINKING****Strategic blocks**

An inability to come up with insights, or coming up with ideas that cannot be implemented, is a sign of blocked thinking. Often individuals may be aware of such blocks themselves, but this may not always be the case. A negative mindset may also be a tell-tale sign that someone has a blockage. In particular, the use of ‘yes, but’ responses and ‘only-one-right-answer thinking’.

Value blocks

One is looking for cues in terms of what people say. If there is a tendency for someone to argue that they have always done something in one particular way and that has always worked, it suggests that they are not open to new ideas and that their own particular values dominate the way in which they tackle problems.

Perceptual blocks

Diagnosing perceptual blocks may be achieved by having several people who are familiar with a problem take a view on it. There should be some consensus of views such that the views of the individuals who have perceptual blocks should stand out.

Self-confidence block

This may be difficult to ascertain unless the individuals concerned confess to having it. It may be apparent from their reluctance to make decisions with respect to the problem in hand. Alternatively, people who demonstrate an aversion to low risk-taking with respect to solving a problem may well have a self-confidence block.

We can see creativity at work every day in the media – for example, in cartoons and comedy-type entertainment shows on the radio and television. Script writers for television and radio need to think creatively just to do their jobs. John Cleese is both an actor and a writer, and has useful thoughts on the subject that may help to deal with the problem of blocks to

MYOPIA IN THE WATCH INDUSTRY

The Elgin watch company has often been quoted as a classic example of a firm that exhibited acute symptoms of marketing myopia on its way to eventually going out of business. The company refused to adapt to the changing demands of the marketplace and failed to take account of the dwindling number of customers for its long-established product: the classic high-quality pocket watch with an anticipated long life-span.

Yet the case of Elgin was only one example of myopia in this industry. English watchmakers dominated watchmaking in the eighteenth and nineteenth centuries. The English verge escapement dominated world markets for many decades. Even when technological breakthroughs were sought, it was the English watchmakers who led the way. Massey's work at the beginning of the nineteenth century led to the eventual use of the lever movement in watches, which finally ousted the time-honoured verge. It also proved a better movement than the cylinder movements used on the Continent. However, the English watchmakers did not move with the times, and their demise at the end of the nineteenth century was largely due to their lack of competitiveness with Swiss and American-produced watches, which met the needs of consumers better.

It may seem rather obvious to us today that in order to survive in the marketplace a company should adapt its strategy to meet the changing wants and needs of its customers. However, the watch industry possesses a number of quirks, and it doesn't necessarily always respond in the way one would expect. Nor does the unexpected always result in total failure.

The Swiss watch industry dominated world markets with its fine clockwork movements, elegant designs and 'quality' image for most of the twentieth century. Quality, elegance and accuracy are key features that people look for in a watch, and some people are prepared to pay very high prices in order to obtain what they want. Up until 1970 watches were powered by clockwork movements, and precision engineering dominated an industry where a key dimension of 'quality' reflected accuracy in time-keeping. An 'Officially Certified Chronometer' certificate handed out by the Swiss authorities was a sure sign that a particular watch met with specific time-keeping standards. Watches carrying such certificates were eagerly sought after and could command high prices. Apart from accuracy, features such as self-winding movements, elegance in design, gold metal casing and sometimes jewel-adorned dials added to the desirability of a watch.

Firms such as Rolex, Patek Philippe, Jaeger, Breguet and Blancpain were world-renowned for their ability to produce desirable watches of such a quality that only the better-off people could afford to own them. A major breakthrough in technology, however, enabled the Swiss industry to invent the quartz movement that made it possible for accurate watches to be mass produced by anyone. The Swiss industry did not use the invention, for fear that it would kill its existing market. However, watchmakers in the Far East grasped the quartz movement, and in a single year the sales of Swiss watches dropped by 25 per cent. This is a case where mindset coupled with paradigm shift spelled disaster for a whole industry.

creative thinking. Popova (2012) states what he has to say on the subject, specifically noting his '5 factors that you can arrange to make your lives more creative':

Space: 'You can't become playful, and therefore creative, if you're under your usual pressures.'

Time: 'It's not enough to create space; you have to create your space for a specific period of time.'

Time: 'Giving your mind as long as possible to come up with something original' and 'learning to tolerate the discomfort of pondering time and indecision'.

Confidence: 'Nothing will stop you being creative so effectively as the fear of making a mistake.'

Humour: 'The main evolutionary significance of humour is that it gets us from the closed mode to the open mode quicker than anything else.'

HOW TECHNIQUES HELP TO OVERCOME BLOCKS

Strategic, value, perceptual and self-image blocks can also be overcome to a great extent by use of the techniques themselves. All the techniques lend themselves to facilitating the strategic process of generating ideas. As a result of using the techniques, ideas and insights will be created where none or few existed before. The techniques act as a stimulus to thinking and help evoke, construct and reconstruct the knowledge and information we hold as individuals in our memory. Where participants engage in group creative problem solving sessions, such as when using brainstorming or synectics, sharing experiences in the group can help build confidence, lessen the risk of making mistakes as individuals and overcome value prejudices we may hold as individuals. In addition, it can also help compensate for the perceptual blocks and biases we may exhibit as individuals. By sharing a problem with someone else we can appreciate how others might view the same problem and how they might gain insights to the problem. These may well be perspectives that our perceptual bias causes us to overlook.

There are many blocks to creativity and some are more destructive than others. Unless these barriers are released, the usefulness of creative problem-solving techniques and approaches will be lost. The particular blocks that are most destructive are the self-defeating beliefs, which state that:

- (a) Fantasy and reflection are a waste of time.
- (b) Problem solving is a serious business; no fun or humour is allowed.
- (c) Feeling and intuition are bad.
- (d) Tradition is preferable to change.

There are many more blocks to creativity, as indicated above, but these barriers need to be removed, as fantasy, originality, fun and change are definitely needed when we use the creative problem-solving techniques. The rejection of conventional lines of thinking is of primary importance for a successful solution to the problem. Creative problem-solving techniques require the user to have an open mind, which will allow the user to generate ideas – some of which will hopefully solve the problem that has arisen.



Figure 2.3
*Why are 2013 coins worth more than 2007 coins?
(See Appendix 2 for the answer.)*



Figure 2.4
Is the aircraft flying towards you or away from you?

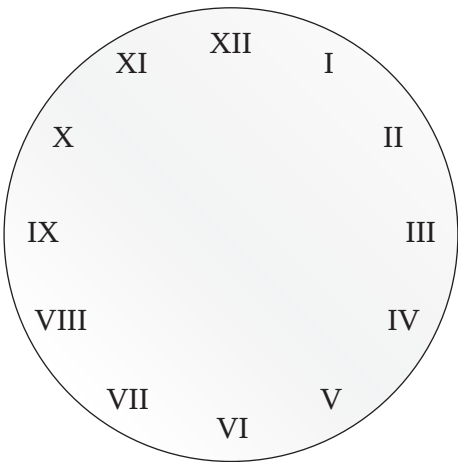


Figure 2.5
The broken clock problem

The broken clock problem

A clock face has roman numerals painted on its glass surface (see Figure 2.5). One day the clock falls on the floor, and an observer is about to pick up the four pieces when she notices that on each piece the sum of the roman numerals comes to the same total. Can you work out what she saw?

A version of the clock problem has been used in creativity training at Manchester Business School by Tudor Rickards, and we are grateful for permission to share the puzzle. See Appendix 2 for an illustrative solution.

BLOCKS TO ORGANIZATIONAL CREATIVE THINKING AND WAYS OF DEALING WITH THEM

Management structure has a considerable influence on creativity in an organization. Top-down management produces centralized decision-making and dissemination of ideas. This can discourage creativity by enforcing disempowered, non-participatory roles on staff who might otherwise make creative contributions (Tsai and Beverton, 2007).

By contrast, bottom-up management leads to employee empowerment as a result of collaboration and shared decision making (Tsai and Beverton, 2007). Arguably, there is also greater participation among employees and the creation of an environment for learning, education and collaboration where people can make use of their creative potential (Cafolla, 2007; Violino, 2006). Changing towards a bottom-up approach to management can be an important step towards removing organizational blocks to creativity.

BLOCKS TO CREATIVITY IN ORGANIZATIONS

People and organizations tend to fall into a variety of traps when trying to become more innovative.

- 1 Identifying the wrong problem
- 2 Judging ideas too quickly
- 3 Stopping with the first good idea
- 4 Failing to get the support of key personnel in the organization
- 5 Failing to challenge assumptions

Some of the major blocks are:

- *Emphasis on managerial control* – control can stifle creativity since autonomy and a degree of freedom are critical ingredients of creative thinking. Moreover, traditional financial controls are not appropriate for long-term innovation efforts.
- *Short-range thinking* – there is a tendency to give priority to quick returns with financially measurable results.

- *Analysis paralysis* – ideas are often over-analysed, and time is lost along with any competitive advantage.
- *Rigid hierarchical structures* – an unpredictable environment requires a responsive organizational structure, and this is not characteristic of most organizations.
- *Tendency to look for one project that is likely to generate a big pay-off* – rather than a number of smaller projects with small to medium payoffs. Good small projects can thus often be overlooked.
- *Market- versus technology-driven product planning* – there tends to be an over-emphasis on market research, in line with the marketing orientation adopted by many companies. While the marketing orientation is very important, it is often implemented at the expense of good ideas that come out of R&D and which never get off the ground.
- *Pressure to achieve and do more with fewer resources* – R&D departments are often penalized for cutting costs; the more the department saves one year, the less it has to play with the next. Paradoxically, the more companies have to cut back on expenditure, the more creative they must become.
- *Lack of a systematic approach to innovation* – a lack of real ideas about how to innovate.
- *Belief that some people are creative* – others are not.

Ways of dealing with such blocks include:

- Encouraging prudent risk-taking.
- Freedom of thought – some degree of autonomy.
- Linking rewards with specific performance.
- Encouraging different viewpoints on problems.
- Positive involvement of top management.
- Continual flow of ideas.
- Responding positively to new ideas.

ELEMENTS AND CONDITIONS OF CREATIVE ORGANIZATIONS

We can divide the characteristics of organizational creativity into four distinct elements (the four Ps of creativity):

- *People* – teams or individuals.
- *Processes* – how ideas are developed and innovation accomplished.
- *Place* – creative environment.
- *Product* – the output of creativity.

We cannot treat each one of the four Ps in isolation from the others. They are interdependent. Perhaps the one to receive the least attention is ‘place’. An organization concerned with creating a climate that influences effective creative activity should provide at least the following:

- *Resources*: these should be appropriate and sufficient.
- *Security*: adequate salary and security of job tenure.

- *Trust*: allow for mistakes.
- *Reward/recognition*: feedback, recognition and reward.

Schein (1984) argues that ‘organisational culture’ is created as part of a complex process in which the way things are done becomes explicit in terms of symbols, structures and procedures in the organization, which in turn reinforce the underlying behavioural norms. These may help or hinder the process of whether an organization functions effectively and/or efficiently. Bessant *et al.* (2001), for example, suggested that everyone in an organization can in theory make a contribution to problem-solving innovation. However, they go on to conclude that most organizations have been operating on beliefs, originating in the ‘scientific management’ approaches developed at the turn of the century, which see a split into ‘thinkers’ and ‘doers’ and which implicitly prevent this from happening.

Creative activities such as the generation of new ideas and the turning of these ideas into useful application in practice occur as a result of an interaction between the person and the situation (Amabile, 1997; Scott and Bruce, 1994). Relevant studies have sought to uncover such things as the effect of collaborations (Abra, 1994; Bullinger *et al.*, 2004), group interactions (Rickards *et al.*, 2001; West, 2002), leadership (Amabile *et al.*, 2004; Howell and Boies, 2004) and organizational structure (Cardinal and Hatfield, 2000; Damanpour, 1996). The importance of climate has also been examined (e.g. Amabile and Gyskiewicz, 1989; Anderson *et al.*, 2004; West, 2002). In the latter respect, climate studies have examined people’s perceptions of, or experiences in, their immediate work environment with respect to dimensions such as support and autonomy (Mathisen and Einarsen, 2004). The results obtained in these studies tend to stress the importance of organizational climate.

QUESTIONS

- 1 Why are people sometimes blocked in their thinking? How can they be helped to overcome the various blockages that occur?
- 2 Why do people find it difficult to solve previously unencountered problems?
- 3 Differentiate between *individual* and *organizational* blocks to creative thinking. What can be done to cope with the difficulties created by these blocks or even to help prevent these blocks occurring?
- 4 Tudor Rickards coined the phrase ‘mental stuckness’. What exactly did he mean by this phrase and what is its relevance to the use of creative problem-solving methods and techniques?
- 5 Morgan (1989) states: ‘Many organisations and their managers drive toward the future while looking through the rear-view mirror. They manage in relation to events that have already occurred, rather than anticipate and confront the challenges of the future.’ Assess the impact that this kind of thinking will have on creative thinking and problem solving in an organization.
- 6 ‘If we were not at times “blocked” in our thinking we would not need creative problem-solving methods.’ What kinds of blockages to creative thinking, as individuals, do we encounter?

- 7 'Problems often don't stay solved, or solutions never quite work out as expected, because the wrong problem was defined.' Comment on this apparent truism.
 - 8 'The first good idea is never the best.' To what extent would you agree or disagree with this statement. Explain.
 - 9 Picasso said: 'Every act of creation begins with an act of destruction.' How transferable is this notion to the domain of creative problem solving? Discuss.
 - 10 How might making use of each of the following help overcome blocks to creative problem solving?
 - watching a magician at work
 - going to the theatre or the cinema
 - family outings
 - visits to junkyards
 - mixing with or talking to different people – perhaps people whose value systems are different from your own
 - day-dreaming to a sound-effects record
 - free association to music
 - browsing around flea markets
 - scanning old science magazines
 - reading historical accounts
 - reading wants ads
 - indulging in or watching sport
 - studying new subjects through introductory-level books
 - following the news – in the newspapers and on television.
 - 11 Organizations thrive on creative thinking but can be reluctant to reward it. Why do you think this is the case?
-

CASES

J.C. losing money

J.C. was unhappy – even worse, he was losing money. His advertising agency had beaten six other firms for the right to represent Ruby's Soap, but what once looked like a wonderful opportunity was turning out to be a major disaster. J.C. had scrapped Ruby's old campaign, which stressed the soap's cleansing powers, in favour of soft-soap testimonials. The new approach, which featured the caretakers of schools and churches talking about how wonderful Ruby's was, had been received well by everyone.

The advertisements differentiated Ruby's from its much larger competition. While competitors were tough on dirt, Ruby's became the one to use when you needed finesse, not muscle. J.C. had been a brand manager with a large fast-moving consumer-goods firm for several years and was particularly pleased with this positioning of the appeal. It demonstrated the kind of know-how and expertise his agency could offer Ruby.

J.C. was constantly on the phone to Ruby's Soap headquarters suggesting marketing moves, promotions and possible new products. But all of this time was costing J.C. money. He was

getting paid just to do Ruby's advertising. While his ideas might be producing Brownie points, they weren't producing profits for his agency. The result was that what had started out as a terrific account was quickly turning into a loser. J.C. wanted to renegotiate. Jack Ruby hadn't asked J.C. to do anything except his advertising. While he valued J.C.'s ideas, he had made clear from the start exactly what he was buying from J.C.

Question

J.C. was losing money on the Ruby's account because he negotiated badly in the discussions that set the level of service the agency would provide. What could he do now?

New Shoe Company

The New Shoe Company, based in the English Midlands, is experiencing a fall in profits. The company measures profits in terms of the annual pre-tax return on capital employed. The sales director says that falling profitability is a reflection of the current slump in the market. Total demand in the marketplace is much less than it was twelve months ago, and the company has struggled to maintain its market share at the previous level as competition has intensified. Competition from European manufacturers has been sharpened by changes in the EEC trading regulations, and Spanish manufacturers in particular have taken advantage of their lower cost structure to make inroads into the British market. At the same time, the New Shoe Company has failed to take full advantage of opportunities in Europe. It has not fully developed its market-niching strategy where it can gain a competitive advantage. The sales director blames the firm's lack of competitiveness on the poor performance of the R&D team and the inability of the manufacturing departments to control costs.

The technical director claims that the firm's products are competitive with any that are produced worldwide. Indeed, in her view, the firm's products are by far the best available at the price offered. She points to the lack of marketing effort expended by the firm in the past year, pointing to the necessity to keep the firm's name before the public at all times, especially when competition is increasing in strength. At the same time, she recognizes that marketing effort requires financing and that this was not adequately provided during the period in question.

The production director points out that the company has been able to lower its manufacturing costs substantially through the introduction of new technology into the manufacturing process. However, he points out that the accounting practices adopted by the firm distort the true picture. In his view, profitability has improved, though this is not truly reflected in the company's management accounts.

The finance director feels that the drop in profitability is attributable to recent acquisitions that the firm has made. Ventures into retailing have not been as profitable as had first been supposed. This might to some extent have been reflective of bad timing on behalf of the company, given the current recession, in making such acquisitions.

The managing director points out that clearly there is a problem and that perhaps one should pay particular attention to what competitors are doing and how the firm is responding from a marketing viewpoint.

Question

Consider the problems created by functional fixedness in this case. How might the situation be resolved?

The problem deputy

Bill was new to the job, and it was also his first management post. He had taken over a department of twenty people and, although he had been looking forward to his new post with great enthusiasm, after two weeks in the job he now had worries and anxieties. His problem was Kurt. Kurt was the deputy head of department and had been with the organization for eleven years. He was sixteen years older than Bill and secretly resented Bill's appointment. Kurt had not been appointed head of department because the other members of the department resented his management style, and the boss of the organization had felt that, although Kurt was an able man, the best interests of everyone would be served by appointing an outsider rather than confirming Kurt in the position of head of department.

Kurt had very strong views about his colleagues, as Bill soon found out. There was much evidence to show that most of his comments had substance to them. He spent much of his time in Bill's office explaining why he thought most people in the department were lazy and needed 'a good whipping' to make them work. When Kurt was not running down his colleagues he would discuss classical music with Bill – an interest that was close to Bill's heart. Bill was secretly pleased when Kurt went off to get on with his normal work. While he found Kurt an interesting and stimulating fellow, he did have reservations about him.

The departmental views of staff on the subject of Kurt were mixed. There was a faction that hated him and wished he would retire early. Kurt did have one or two friends, however, who were more sympathetic to his views and explained his aggressive manner away as justifiable frustration and disappointment. Bill was anxious to get off to a solid start in his new job and recognized that he lacked experience. He also felt that he needed to sort out the business of who was to be his deputy fairly quickly. Should he continue with Kurt in this role? Should he appoint someone else? Should he do without a deputy? Bill's boss wasn't much help in the matter. 'Well, you have to manage with what you have,' he said in a noncommittal way. 'Kurt isn't a bad bloke at heart.' Bill felt he couldn't think clearly in the matter. Something was causing a block to his thinking processes, and he could not get to grips with it.

Question

Can you identify the main sources of blocks to thinking in this instance? What should Bill do?

Tunnel vision

The drive to complete the project was on – until local resistance was encountered. There seemed no way of getting round the problem. The locals wanted cash to get out of the way of the highway which was to be driven through their homes – more cash than the company was prepared to offer. 'If we pay up,' said Joe, 'everyone will get to know about it and everyone is going to want a cut. The project has enough on-costs. We won't pay up.'

'I guess we can reroute at little extra cost. It'll mean an extra couple of miles of highway and a tunnel, but we won't have to meet the kind of resistance the locals are putting up here. It'll cost extra, more than we'd pay the locals, but heaven knows how much it would cost if we had to pay out to everyone who stood in our way.' Tom smiled.

'Sure agree with that,' said Joe, drawing on his cigar. 'Still, we'd better analyse the figures in depth. After all, we have to report on the change of plans to the Board in due course, and they will require justification for the change. How long do you reckon it will take to get the figures?'

Tom grimaced. 'Maybe a few days. If we have to get clearance from the Board before we proceed, that could add on several weeks. Also, of course, we'd have to pay the men while they were idle. Then there is the rent on the equipment; the interest on loans.'

'Hey, hang on a minute. This could cost us a lot of money. Can't you get any rough estimates at all?' Joe scowled.

'Jupiter, Joe, all this takes time.'

'But we haven't got time. Before we know it, the locals will have wind of the fact we are up to something and we'll have protesters, the government and the police breathing down our necks.' Joe wasn't pleased.

'Well, we have to go through formal channels. The Board meets once a month. The last meeting was three days ago – 'Tom was interrupted.

'I think this calls for drastic action. There could be a big pay-off here if we just forge ahead one way or the other. Perhaps we ought just to pay up to the locals and hope for the best,' Joe shouted.

'I think we ought to explore the lie of the land. Get more information and find out what the locals are really up to,' Tom said coolly.

'Every day that passes we have fewer resources. We cannot afford to do that. Anyway, I don't think it is necessary. What if we just let the locals cool their heels for a few days? We'll make them sweat. Then we'll offer them what we said we would. They'll see sense, I'm sure,' Joe reflected.

Question

How do you think the problem should be resolved? What are the major blocks to its resolution?

The only one

At tea breaks Sally preferred to sit alone. She was the only female computer programmer in the building. It wasn't that she didn't like her male colleagues, it was just that they always spoke in a patronizing way to her, talked about football all the time except when the conversation was interspersed with sexist jokes or sexist remarks. She could complain, she knew, but what good would it do? She wanted to keep her job.

Sally had taken to bringing the morning newspaper into the office so that she had something to read during the breaks. One day she left the newspaper open on the desk at the situations vacant pages while she went to the toilet. On her return she was teased by her colleagues about looking for another job. She thought nothing more of the matter, putting it down to the

clownish behaviour of her male colleagues. However, it soon became a topic of conversation among her colleagues, which she could not help but overhear. Sally, they said, was looking for a new job because she was the only woman in the office. It soon became monotonous. Every day the same remarks would be made and Sally would simply smile, but it began to get on her nerves, so much so that she began to lose sleep, wakening in the night from dreams in which she was anxiously searching for jobs while listening to the taunts of her colleagues.

Question

What action should Sally take to deal with this problem?

FURTHER READING

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Theories of creativity and the creative problem-solving process

The beginnings of television

In 1842, Alexander Bain devised a machine – developed five years later by Bakewell – for transmitting drawings by electric wire. In the receiver, electrolytic action was used to draw the picture. Over fifty years later, the German physicist Arthur Korn modernized the system by substituting photo-electric action for the electro-chemical. Once photo-telegraphy was established, the transmission of live pictures seemed a possibility. It was simply a problem of speed – of scanning the scene to be transmitted, of sending the impulses to the receiver, and of assembling them there so quickly that the eye would accept them as an image of a real-life scene. A crude, practical solution of the scanning problem had been discovered by Paul Nipkow in 1882. Two developments had stimulated his thinking: the invention of the telephone and the discovery that selenium allows an electronic current to pass more freely when the sun is shining on it (which later led to the invention of the photo-electric cell). Nipkow realized that variations of electrical resistance according to the amount of light falling on selenium pointed to the possibility of transmitting a scene by electricity. This was the beginning of electronics, and it prompted other inventors to approach the problem of television from a different angle. Many of the technological achievements we see today are the product of a chain of creative thought and problem solving conducted by several different researchers. To understand how these achievements have been brought about we need to understand the nature of creative thinking and creative problem solving.

INTRODUCTION

Notions about creativity and creative problem solving are complex. There is no one standard authority on the subject, and information about these processes is therefore scattered and to be found in different disciplines. In this chapter I try to pull together some of the ideas that pertain to the subject in the hope of providing some background against which to appreciate the various steps of the creative problem-solving process which are described in subsequent

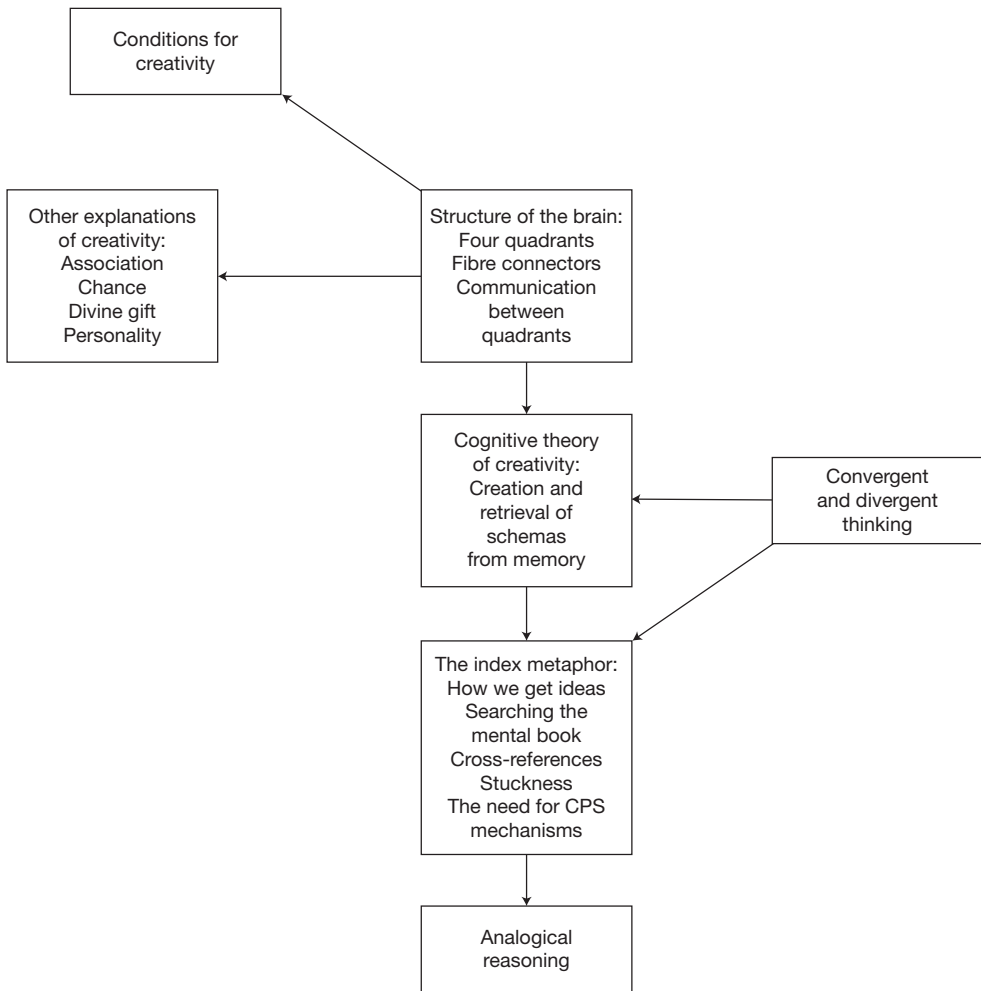


Figure 3.1
Overview of the chapter

chapters. Figure 3.1 provides an overview of the main thread of the discussion which occurs in this chapter.

In this chapter we look at general observations about the ideation process. This is followed by an examination of some of the ideas of those who think that creativity is explained best by the neuro-physiological functioning of the brain. Whole-brain and two-brain theories exemplify this latter approach. We shall see a connection between the neuro-physiological functioning of the brain and the cognitive theory of creative problem solving discussed later in the chapter. Before looking at problem solving and creative problem solving, however, we give attention to two other important contributions to the theory of creative thinking. First we look at the notion of divergent and convergent thinking, and then we consider a suggestion that the conditions under which ideation takes place are very important. We finish the chapter by

examining ideas about analogical reasoning. Analogical reasoning is a strong feature of some of the techniques we will look at in later chapters (lateral thinking, synectics and the paradigm breaking techniques) and needs to be grasped in order to fully understand what they are about. The theoretical issues raised in this chapter act as a background for appreciating the elements of the next chapter which introduces creative problem solving.

CREATIVE THINKING

Some observations on ideation

Locke ([1690] 1964) maintained that the source of all ideas is human experience and understanding. Ideas, as he saw them, sprang from knowledge, which in turn is derived from observation of the external world as well as from awareness of our own internal ruminations on these observations. 'Knowledge' remains a somewhat vague notion, but implies more than remembered observations and includes some form of interpretation of these observations. Ideas may not merely come into and go out of our awareness like randomly displayed data elements, but instead can be consciously related to each other in ways that we begin to find useful, interesting, satisfying or even entertaining. Idea processing takes individual ideas and manipulates, synthesizes and associates them with one another until they form a larger contextual pattern that we can consciously relate to some human concern or problem.

Idea processing does not rely on either mathematical algorithms or other kinds of structured logical step-by-step solution methods. Many researchers have observed that the non-specifiable type of idea processing appears to be the more dominant approach of expert high-level decision makers. Mintzberg (1976), for instance, contrasts the analytical reasoning process of management science with the intuitive thought process of the manager and concludes that analytic planning has had little impact on how top management functions. Isenberg (1984) reported that 'thought sampling' statements describing how senior managers think indicate that they do not engage in solving isolated problems but deal with interconnected networks of problems and use what he calls 'high intuition' (not guesswork) in which rapid pattern recognition takes place and solutions are generated and regenerated as new information is obtained.

THE INVESTMENT THEORY OF CREATIVITY

Sternberg and Lubart (1991, 1995) argue that creativity requires a coming together of six clear-cut yet interconnected assets: intellectual abilities, knowledge, styles of thinking, personality, motivation and environment. Let us consider each one of these in turn.

Intellectual skills

Three intellectual skills are identified:

- 1 the ability to see problems from different perspectives and to move away from approaches involving conventional thinking;

- 2 the ability to evaluate which ideas are promising and which ones are not; and
- 3 the ability to persuade others regarding the value of ideas that are worth pursuing.

Being able to combine these skills is the key but one has to acknowledge that simply having analytic skills alone may simply produce critical thinking, but not creative ideas. Similarly, having just synthetic skills simply produces ideas that are not evaluated for their usefulness in addressing problems. Finally, having persuasive ability alone may get ideas adopted not because the ideas are good, but because the ideas have been presented in a persuasive manner.

Knowledge

Knowledge is essential for any progress to be made. One cannot move forward if one does not fully understand the point from which one starts. However, one has to appreciate that one's perspective on a problem may be hindered or assisted by knowledge of a situation since it may reflect an entrenched perspective reflecting the way in which one has seen problems in the past.

Thinking styles

Thinking styles relate to how skills are employed by people. A preference for thinking in new ways is a desirable feature of creative thought. This will encompass adopting a global view as well as an ability to distinguish the wood from the trees and thereby recognize which questions are important and which ones are not.

Personality

Numerous research studies (Lubart, 1994; Sternberg and Lubart, 1991, 1995) argue for the importance of certain personality attributes that are associated with creative performance. Willingness to overcome obstacles, preparedness to take sensible risks, propensity to tolerate ambiguity and self-efficacy feature among desirable attributes.

Motivation

Intrinsic, task-focused motivation is regarded as essential to creativity. Amabile (1983) and others stress the importance of this and argue that people who love what they are doing and focus on the work rather than the potential rewards are most productive from a creative perspective. Finding a way of seeing something as being worthy of one's interest may be the factor that stimulates motivation. This may occur spontaneously – love at first sight – or occur out of necessity – because it is essential for one's self-preservation.

Environment

An environment that is supportive and rewarding of creative ideas is helpful since possessing the internal means required to think creatively may be insufficient without some environmental

support (such as a means of putting ideas forward). Business environments do not usually make putting forward creative ideas an easy task.

Bringing together these six components is the essential task. However, there may be thresholds to be attained for some components (e.g. knowledge) below which creativity is not possible irrespective of the levels achieved with respect to other components. Nevertheless, a strength on one component (e.g. motivation) can counteract a weakness on another component (e.g. environment). Lastly, interactions can occur between components, such as knowledge and motivation, to produce a high degree of creativity.

Amabile and colleagues (Amabile, 1996; Hennessey, 2003; Hennessey and Amabile, 1988) lend support to Sternberg's investment theory approach. They argue that the combination of a variety of environmental and person variables are essential for creativity. Their research rests on a three-part conceptualization of creative performance. They suggest that a problem should be approached with the appropriate domain skills (background knowledge), creativity skills (willingness to take risks, experiment, etc.) and task motivation. Under the best conditions the confluence of these three factors produce what Amabile (1997) refers to as the 'creative intersection'. Arguably, through teaching and learning creativity skills can be acquired, but it is how the environment helps to shape motivational orientation that is less predictable. We will revisit these ideas again in Chapter 5.

THE BRAIN AS AN INFORMATION PROCESSOR

The brain has two cerebral hemispheres – a left and a right. The primary mental processes of these hemispheres include vision, hearing, body senses, reasoning, language and non-verbal visualization. Within each hemisphere is to be found one half of the limbic system. This is a control centre that governs such things as hunger, thirst, sleeping, waking, body temperature, heart rate, blood pressure and emotions. The limbic system plays an important role in transferring incoming information into memory. The two cerebral hemispheres and the two halves of the limbic system make up the four quadrants of the brain. The upper quadrants represent the cerebral hemispheres while the lower quadrants represent the two halves of the limbic system.

Fibres connect the two cerebral hemispheres, and these fibres carry communications both within and between the two hemispheres. When solving complex problems or other intricate work, different thinking methods are required. The brain switches signals back and forth very rapidly between different areas within the two hemispheres via the fibre links. Switching thinking modes within the cerebral hemispheres (within each of the two upper quadrants) is simple, but switching between the two lower or upper quadrants is more difficult. Diagonal switching is most difficult because there are no fibre connections between diagonally opposite quadrants of the brain.

Left and right sides of the brain

During the 1960s, research on the brain caused scientists to conclude that both hemispheres are involved in higher cognitive functioning. It was found that each half of the brain produced different modes of complex thinking. The main argument to develop was that there appear to

be two modes of thinking, verbal and non-verbal, which tended to be conducted separately by the left and right hemispheres respectively. This in turn led initially to a number of 'brain'-related theories concerning creative thinking, notable among which was Roger Sperry's Left Brain/Right Brain theory (see Le Boeuf, 1994). According to this theory, the left brain is used for logical thinking, judgement and mathematical reasoning, while the right brain is the source of dreaming, feeling, visualization and intuition.

The Whole Brain/Four-Quadrant Model

Herrmann (1990) showed that it is possible to build a model of the human brain with two paired structures, the two halves of the cerebral system and the two halves of the limbic system. This permits one to differentiate between not only the more popular notions of left/right brain, but also the more sophisticated notions of cognitive/intellectual which describe the cerebral preference, and visceral, structured and emotional which describe the limbic preference.

Herrmann's *Whole Brain Model* also made use of the concept of dominance. Evidence indicates that, wherever there are two of anything in the body, one of them is naturally dominant over the other. For example, we may be right- or left-handed. We can also be thought of as predominantly right- or left- 'brained'. The implications of this for the way in which we prefer to do things are important. Indeed, sometimes our preferred way of doing things may well be counterproductive. Predominantly left-brained thinkers may experience more difficult relationships with colleagues than right-brained thinkers because they are not as sensitized to other people. On the other hand, it may be that predominantly right-brained thinkers need to have goals and a schedule set for them to help them be more efficient.

The Whole Brain Model (Figure 3.2) presents four distinct thinking styles:

- 1 The upper (cerebral) left
A analytical, mathematical, technical and problem solving
- 2 The lower (limbic) left
B controlled, conservative, planned, organized and administrative in nature
- 3 The lower (limbic) right
C interpersonal, emotional, musical, and spiritual
- 4 Upper (cerebral) right
D imaginative, synthesizing, artistic, holistic and conceptual modes

Among other things:

- Predominantly A quadrant thinkers prefer organizing information logically in a framework, listening to lectures and reading textbooks, studying example problems and solutions, thinking through ideas, doing scientific/academic research, judging ideas based on facts, criteria and logical reasoning, dealing with reality and current problems.
- Predominantly B quadrant thinkers like finding practical uses for knowledge learned, planning projects, practising new skills, writing practical guides about how to do something.
- Predominantly C quadrant thinkers like to be very organized and precise in their work.

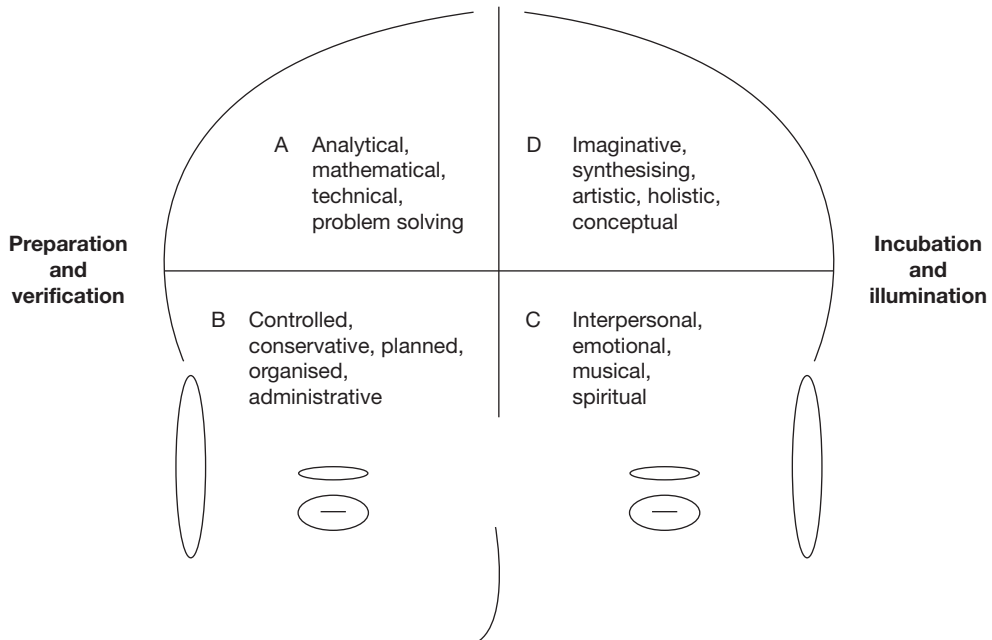


Figure 3.2

Brain theories: the Whole Brain Model (Hermann/Wallas)

- Predominantly D quadrant like to take an overall view of new topics (not the detail), to take the initiative, ponder on possible outcomes of actions, use visual aids, solve open-ended problems, enjoy wild ideas, experiment, rely on intuition rather than on logic, synthesize ideas, approach a problem from different angles.

From the point of view of undertaking creative problem-solving activities, type D thinkers seem to have the most favourable frame of mind for this activity.

Wallas's model of the creative process

Graham Wallas (1926) set down a description of what happens as people approach problems with the objective of coming up with creative solutions. He described his four-stage process as follows:

- 1 In the *preparation* stage we define the problem, need, or desire, and gather any information the solution or response needs to account for, and set up criteria for verifying the solution's acceptability.
- 2 In the *incubation* stage we step back from the problem and let our minds contemplate and work it through. Like preparation, incubation can last minutes, weeks, even years.
- 3 In the *illumination* stage, ideas arise from the mind to provide the basis of a creative response. These ideas can be pieces of the whole or the whole itself, i.e. seeing the entire

concept or entity all at once. Unlike the other stages, illumination is often very brief, involving a tremendous rush of insights within a few minutes or hours.

- 4 In *verification*, the final stage, we carry out activities to demonstrate whether or not what emerged in illumination satisfies the need and the criteria defined in the preparation stage.

The first and last stages are left-brain (quadrants A and B) activities, whereas the second and third stages belong to the right brain (quadrants D and C).

It should be noted that Wallas's theory comes under criticism from Weisberg (1986), particularly with respect to incubation. He details studies to substantiate his claim and believes that the role of incubation in creative problem solving is ambiguous and may, in fact, have little function. Research quoted by Weisberg suggests that none of the four stages can be said to have any supporting evidence. He argues that it is the conscious mind that is creative. However, recent research on incubation by Segal (2004) suggests that a break in the attentive activity devoted to a problem may eventually facilitate the solution process. This gives rise to a new hypothesis based on analysis of the structure of insight problems and their solution process. According to this hypothesis, no activity takes place during the break. The break's only function is to divert the solver's attention from the problem, thus releasing her mind from the grip of a false organizing assumption. This enables the solver to apply a new organizing assumption to the problem's components upon returning to the problem. Moss (2003) argues that the process may be influenced by the impact of environmental clues. When a problem is abandoned, a solution may subsequently and unexpectedly emerge. The intervening period, known as incubation, has sometimes been ascribed to opportunity assimilation. According to this theory, it passes to a problem create failure indexes, which ensure that random stimuli in the environment are detected and utilized.

Cropley's stages model

Cropley (1997) added various stages to Wallas' model. First, he argued that there was a need to recognize or 'find' a problem about which the person can be creative (this is the Preparation stage). Second, he considered there was a need to communicate the creative outcome to others (this he referred to as the Communication stage). Third, he envisaged it was necessary to have the outcome judged by people with the relevant cultural background (this he referred to as the Validation stage). The Preparation stage makes the process of problem finding more explicit. Creative ideas can be produced without Communication and Validation but they cannot receive 'socio-cultural validation' (Cropley and Urban, 2000). This may explain why management may sometimes come up with an idea which they think will be good for the workforce only to find that the workforce has a completely different view of it!

SOLVING A PROBLEM BY GAINING SUDDEN INSIGHT

Visualize a standard chessboard with any two white squares removed. Is it possible to place 31 dominoes of size 2×1 so as to cover all the remaining squares?

See Appendix 2 for the answer.

CONVERGENT AND DIVERGENT THINKING

Guilford (1967) claimed and cited evidence to support the view that divergent thinking processes, as opposed to convergent thinking processes, are related to creativity. Divergent thinking involves a broad search for decision options with respect to a problem for which there is no unique answer. In the divergent processes, the generation of alternatives involves finding many combinations of elements that may provide many possible answers. Fluency of thinking and originality characterize a divergent search for alternatives, rather than a rigorous adherence to prescribed steps and criteria for finding some uniquely ‘correct’ result. In a convergent search, the opposite is true; that is, it is a unique solution to meet the prescribed criteria that is sought. As Guilford (1975) points out, however, these two modes are not necessarily used in isolation and can be intermixed in so far as a divergent approach can be used on the way to a convergent solution. The extent to which the whole process can be characterized as divergent or convergent is relative rather than absolute and depends on the degree of limitations imposed on the answer. We might thus conclude that both divergent and convergent thinking contribute to the gaining of creative insights.

Guilford, as discussed by Dacey (1989), argues that a major impediment to effective convergent thinking lies not in the use of a problem solving paradigm but in the selection of a good one. Dacey (1989) has referred to Edward de Bono’s theories of divergent thinking, which combine vertical and lateral dimensions. De Bono states: ‘vertical thinking digs the same hole deeper; lateral thinking is concerned with digging a hole in another place’ (Dacey, 1989). Seemingly, if that hole is in the wrong place, no amount of logic is going to put it in the right place. Therefore, although the Creative Problem Solving Method (CPSM) requires these dual thought processes, the model will not be constructive unless the ‘digger’ is on the right track.

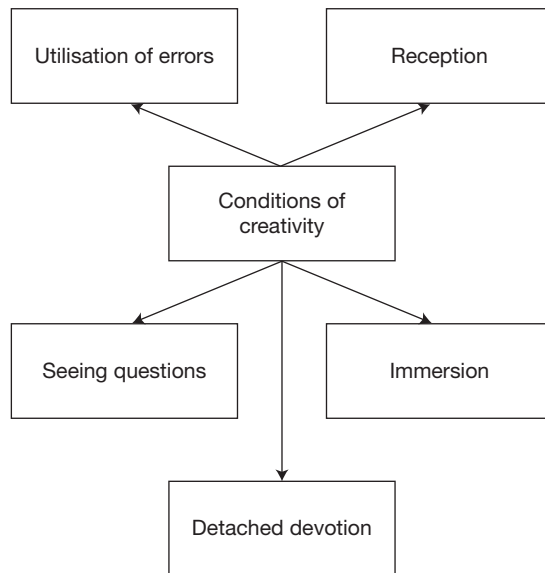
It is argued that the function of divergent thinking is to ‘broaden out’ the thought process and thus reject mindset and disregard constraints on problem solving. Convergent thinking applies a greater degree of judgement and narrow focus. The argument is, however, the subject of some criticism. Weisberg (1986) considers that divergent thinking is not, in fact, an important aspect of creativity and that studies have shown that creative ability is not related to divergent thinking ability. He argues that novel solutions to problems can, in fact, be achieved without it. He feels that creative problem solving does always require a fresh perspective. Weisberg is critical of creative problem-solving methods. However, one should bear in mind that his evidence for such a claim is based upon only two illustrations.

THE CONDITIONS OF CREATIVE THINKING

Mary Henle (1962) outlined what she considered to be the necessary conditions for creative thinking (Figure 3.3). There were five such conditions: receptivity, immersion, seeing questions, utilization of errors, and detached devotion.

Receptivity

The generation of creative ideas requires us to hold a certain attitude. It is thought that receptivity involves detaching oneself from one’s current activities and simply paying attention

**Figure 3.3***The conditions of creativity*

to the ideas that arise. The attitude is present in those who have experienced and reported mystical or near-mystical experiences.

Immersion

Newton arrived at the law of gravitation by always thinking about it, and similar feelings were reported by Poincaré (1952). Wertheimer ([1945] 1959) writes that Einstein tried for years to clarify the relation of mechanical movement to electromagnetic phenomena. Moreover, as Humphrey (1948) indicates, Gauss had been trying in vain to prove a theorem for four years when the solution suddenly came to him. In general, the mathematician tends to get good ideas in mathematics, the musician in music, the psychologist in psychology. Creative thinking arises more easily in fields and in relation to problems that we know a good deal about. However, there is a paradox here, for our knowledge may work against our creative thinking – we tend not to think about what we know. Existing ideas tend to blind us to new ones, and it seems that creative ideas do not occur to us unless we spend a great deal of time and energy engaged in just the activity which makes their emergence most difficult. The paradox is not easy to solve.

Seeing questions

It is argued that a question requiring an answer can, in fact, limit creative thinking since it is unlikely that in our thinking we will go beyond the question before us (Langer, 1942).

While a question often limits the kind of answer we obtain, it may be argued also that the really creative aspect of problem solving may be more precisely to pose a question than to answer one. Alternatively, the task may be viewed to revise a problem with which we are confronted in order to see it in a new way or in a broader context. As Wertheimer ([1945] 1959) said: 'Often in great discoveries the most important thing is that a certain question is found.'

Utilization of errors

While the goal of problem solving may well be correct solutions, we must recognize the role of error in helping us to arrive at better solutions. In science wrong hypotheses increase our knowledge just as much as correct ones. Error can present a new problem and thus stimulate thought.

Detached devotion

Creative work is full of paradoxes, and none more than the need of the creative thinker to be both immersed in the problem yet at the same time sufficiently detached from it to see it consistently afresh. One must recognize that very intense motivation to solve a problem may well impede the problem solving process. Concentrating on the goal to the exclusion of other relevant aspects of a problem often prevents solution of a problem. The creative thinker must stand back from the problem so that it can be critically examined and evaluated. It is possible that a function of the incubation period suggested by Wallas (1926) enables one to achieve that sufficient detachment.

ORIGIN OF CREATIVITY

There are a number of schools of thought as to the origin of creativity (Henry, 1991): grace, accident, association, cognitive, personality.

Grace

Creativity is something of a mystery, drawing forth images of wonderful insights, imaginative efforts, illumination and intuitions that come from nowhere. It seems the work of magic. The idea of genius may add force to this notion since creative artists, musicians, etc., seemed to be endowed with superhuman potential. Creativity in this sense is seen as a divine gift.

Accident

This is the opposite of it being a divine gift. It rises by chance. Holders of this view offer various types of accidental discovery such as that of immunization arising from an interruption in work, radioactivity from the wrong hypothesis, and the smallpox vaccination from observation.

ACCIDENT AND THE GAINING OF CREATIVE INSIGHTS

After the death of Niépce, his collaborator in research, Daguerre, a decorator and diorama showman, worked on alone in the search for ways to capture images obtained through cameras permanently. By the autumn of 1837 he had realized that silver compounds such as silver nitrate, and particularly silver iodide, possessed the kinds of properties for which he and Niépce had been searching.

He had put a few plates, which he thought were spoiled because he had not exposed them long enough, into an old cupboard. After a few weeks he took them out with the intention of washing them and using them again. To his complete surprise, the pictures on them were clearly visible. What had occurred? How could the plates have developed by themselves? He cleared out everything he had stored in the cupboard until it was empty. There was nothing there to provide any explanation. His curiosity was piqued, however, and he argued to himself that there must have been something in the cupboard to account for the apparently inexplicable phenomenon.

Getting down on his hands and knees, he explored the recesses of the cupboard in detail. There he discovered, in the narrow fissures at the bottom of the cupboard, a number of glittering balls of mercury which had escaped from a broken bottle. Immediately he recognized what must have occurred. The silver iodide plates had been developed by the chemical reaction of the mercury vapour.

Daguerre tested his theory by exposing a new plate for a short time and heating it over a bowl of mercury in a dark room. The picture appeared as if by magic. Fixing the plate in sodium sulphate, which dissolved the silver halides, he peered at the first 'daguerreotype'.

Question

'Accident' obviously had its role to play in this discovery, but there were other factors, too. Can you identify these other factors?

Discoveries

Velcro is a Swiss invention dating from 1948. Returning from a day hunting, the engineer Georges de Mestral noticed that burdock seedheads clung to his clothing. Under the microscope he discovered that each of these heads was surrounded by minute hooks allowing them to catch on to fabrics. It then occurred to him to fix similar hooks on fabric strips which would cling together and serve as fasteners.

Eight years were needed to develop the basic product: two nylon strips, one of which contained thousands of small hooks, and the other even smaller loops. When the two strips were pressed together, they formed a quick and practical fastener. The invention was named Velcro: from the French velours (velvet) and crochet (hook).

Association

This is the most popular and suggests that applying procedures from one area to another gives rise to novel associations, and that such associations form the bedrock of creative ideas. The notion was popularized by Koestler under the term ‘bisociation’, and it underlies the justification for many divergent thinking techniques, such as lateral thinking and brainstorming.

Cognitive

Many inventors work at a problem for years. Research has concluded that ten years of intense preparation is needed for significant creative contributions. Deep thinking about an area over a long period leaves the discoverer informed enough to notice anomalies that might be significant. Highly creative people are strongly motivated and seem able to concentrate over a long period.

Personality

Creativity is a state of mind that can be learned. Some people seem to have a facility for it while others do not, but they can improve with practice. Mental barriers to creativity have to be removed to allow innate spontaneity to flourish. Creative acts are not isolated acts of perception; they require an emotional disposition, too, for any new idea replaces and in effect destroys the previous order. It takes courage and persistence to brave the resistance that any change seems to engender.

The five perspectives make some valid points. While not disclaiming the relevance of grace or personality here, we pay particular credence to accident, association and cognitive theories in suggesting the framework for creative problem solving, which we develop in this book.

THE COGNITIVE THEORY OF CREATIVITY

Cognitive processes have been a much disputed topic for many years. Various schools of psychology, the Psychoanalytical, Gestalt and Associative, all have their various perspectives on the subject. When reading the following it is important to bear in mind the earlier sections of this chapter which looked at the neuro-physiological structure of the brain and its relationship to thinking modes.

At the core of the thinking process is memory. It is thought that there may be both long-term and short-term memory. Short-term memory can hold only a small amount of information at any one time. Long-term memory, on the other hand, has a vast information-storage capacity. If we paid attention to all the things our senses are reporting at any particular moment and took them all into consideration, it would be very hard for us to decide what to do. We can only hold a few items in our short-term memory, and that is what enables us to focus on what is important and to act quickly.

Long-term memory may be thought of as being filled with all the images, sounds, odours and other types of sensory data in an assembled form and which we hold as a symbolic picture of our remembered information. Information itself is learned from our experience and stored in chunks (‘chunking’) along with clues associated with the information.

We can often recall the wanted material by recalling the unwanted accompaniment. The learned material and the cues form complex networks of information. Thus, when we are trying to think of objects that might resemble ‘red faces’ we might find it easier not to concentrate our minds upon ‘faces’ but rather to make connections with similar images – beetroots, the setting sun, etc. From a creativity point of view, it is how we make the connections along and across the networks that is of interest.

According to the connectionist or parallel distributed processing model proposed by McClelland (1981), information about people, events and objects is stored in several interconnected units rather than in a single location. The strength of the connections between these units increases as a result of learning. Subsequent retrieval of information about a particular person, event or object involves, gaining access to one or more of the relevant units, followed by a spread of activation to other relevant units.

One of the general characteristics of connectionist or parallel distributed networks is that they provide an explanation of the fact that we seem to possess both episodic (or autobiographical) memories and semantic (or knowledge-based) memories. By way of illustration, we possess information about several cars with which we are familiar and we also have knowledge of the general concept of the car. According to McClelland and Rumelhart (1986), the stimulus word ‘car’ leads to the activation of several units referring to specific cars, and averaging process indicates the typical features of cars in general.

The brain as a human information-processing system

The process of thinking effectively means accessing very large volumes of information in long-term memory via a bottleneck memory space, which takes the form of short-term memory. While the speed of access to long-term memory is extremely rapid, it appears possible to consider only small amounts of information at a time. Bottlenecks are symptomatic of inefficient operation and usually result in a slowdown or cessation of operation if they become overloaded or choked. This view of the human information-processing system points to limitations in terms of its efficiency. In problem solving or trying to think creatively, we immediately come up against these limitations. Creative problem-solving aids need to help us circumvent these difficulties if they are to be useful aids to thinking.

Not only is the efficiency of the human information-processing system constrained by its own structure; it is also affected by how people use it. It is thought that through a process of selective perception or filtering we pay attention to only certain features of things we sense. The concept of a perceptual filter is important because of the factors that constrain it – for instance, beliefs, attitudes, etc. Mindsets may occur because of the various beliefs and attitudes we hold and the impact they have on our perceptual filter.

How knowledge is stored in memory

Understanding how knowledge is thought to be stored in human memory enables us to appreciate how long-term memory may be organized and how the search of long-term memory may be conducted. Among the earliest ideas on representation were those of Quillian (1968), who introduced the notion of the semantic network (Figure 3.4). This maintained that knowledge can be represented by a kind of directed, labelled graph structure in which the basic structural element is a set of interrelated nodes.

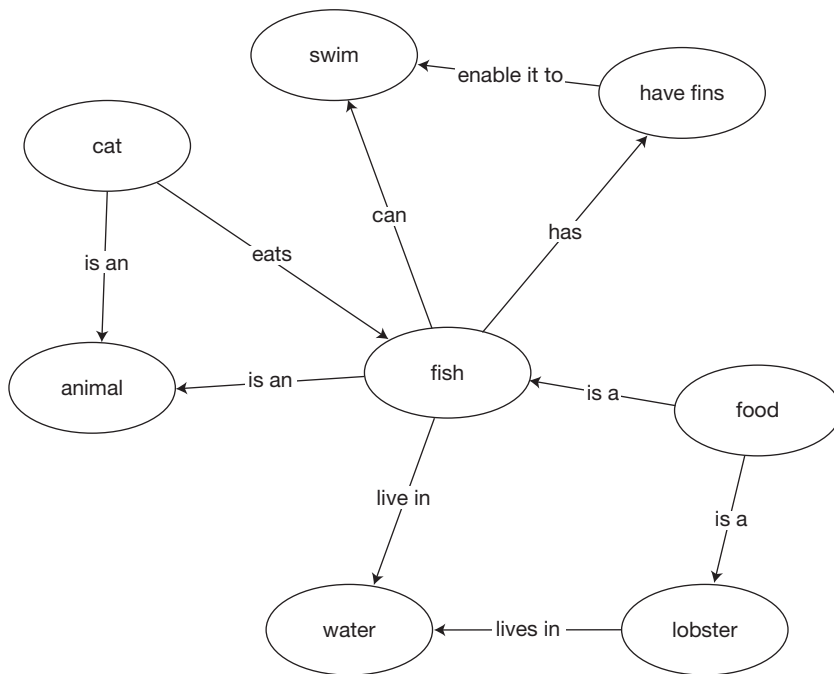


Figure 3.4
Semantic network

Semantic network theory has a place in the structure of representation, but it does not allow one to structure knowledge into higher order representational units. Nevertheless, externalizing this form of representation can be employed effectively in facilitating creative thinking.

Schemas

It is the major function of schemas to add a structure that allows for the encoding of more complex relationships among lower level units (see Rumelhart and Norman, 1983). Schemas are learned as a result of experience and reside in memory to be called upon at any time. Schemas are packets of information in which there is a fixed part, representing those characteristics that are always true of exemplars of the concept, and a variable part, which need not always be true. The schema for the concept of 'elephant' would contain constant parts such as 'elephant has a trunk' and variable parts such as 'elephant can be found in a zoo'. Variables have default values if the incoming information is unspecified. Thus, the concept of 'pensioner' might have as its fixed part 'is retired from his or her former occupation', but unless the variable 'age' is specified this would default to 'old'. Schemas can also be embedded within one another so that a schema consists of a configuration of sub-schemas and so on.

According to schema theory, schemas influence the way that new information is processed. The schema that is currently activated guides the selection of what is to be encoded and stored in memory, so that information relevant to that schema is more likely to be remembered than non-relevant information. The schema provides a framework within which the information can be stored and which can be used at retrieval to guide search processes.

Scripts, deltacts and MOPS

Workers in the area of Artificial Intelligence have made important contributions to cognitive science. This perspective suggests that we make use of special types of schemas known as scripts and deltacts (Schank and Abelson, 1977) in dealing with problems. Scripts allow people to make inferences about a situation and are assembled from smaller data elements called MOPS (memory organization packets). MOPS serve to organize experiences around essential similarities, enabling people to recognize old situations in new guises and to draw conclusions.

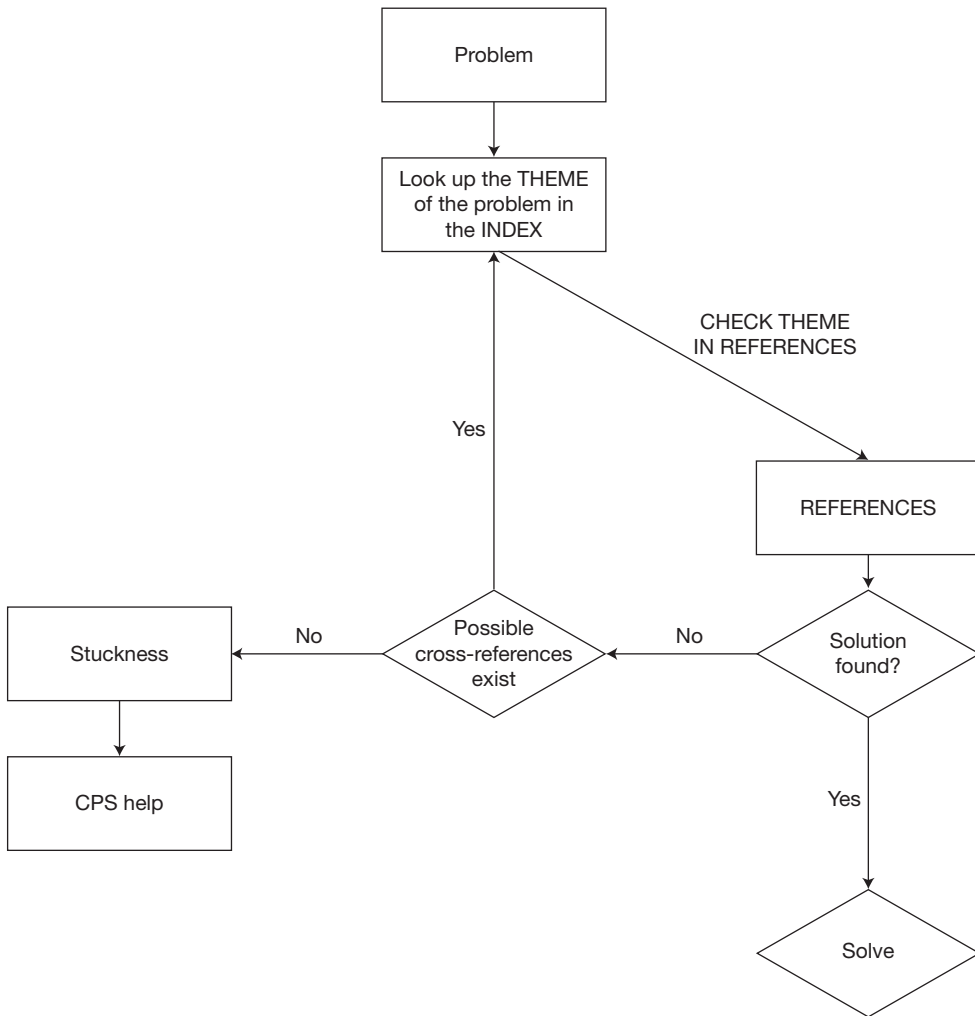
Scripts are stereotyped responses based on experience. It is argued that, in trying to cope with a new situation or problem, people try to recall previous ways in which they have dealt with similar problems – they try to recall a script. A script is an organized memory structure that describes a suitable sequence of activities to deal with a particular problem or situation. Scripts guide what people do, think and say. Retrieving an appropriate script from memory allows people to deal with a situation or a problem in an effective manner.

Schank and Abelson (1977) suggested that people undertake ‘goal directed behaviour’ to cope with problems or situations where a relevant script cannot be retrieved (i.e. because they have never learned one in the first instance). Discovering the goal may be part of the process, and sometimes the goal may have to be implied from several aspects of a description. In addition, one has to find a set of ways in which to satisfy the main goal. These take the form of subgoals and associated plans, which Schank and Abelson (1977) termed ‘deltacts’.

Schank and Abelson (1977) argued that higher level structures, which they termed themes, serve as nuclei around which goals, plans and scripts are organized. In trying to solve a problem it is suggested that we organize our thoughts around a theme. For example, imagine that the boss has decided to remove the opportunity of earning extra money from people working in an office. There are various possible responses that workers could make to this action, but one theme that could emerge is that of challenging the boss’s authority to prevent people earning extra money. Scripts, deltacts, etc., would be organized around the theme of ‘challenge authority’ and, as a consequence, solutions to emerge might be such things as ‘appeal to a higher authority in the organization’ or even, if it were possible, ‘flout the boss’s authority’.

HOW WE GET IDEAS: THE INDEX METAPHOR

Building on the concept of schemas, scripts, deltacts and themes, we can develop a metaphor to show how ideas may be generated and the role that creative problem-solving aids can play in helping the ideas to emerge. This is the index metaphor (Figure 3.5). The index metaphor supposes that we store all our information, knowledge and experience in a huge ‘mental book’ which has an index and cross-referencing facilities. How we deal with a problem is influenced by our perception of it. We take our perceived problem, identify the main theme and look it up in the index of the ‘mental book’. The index provides us with a number of references to entries regarding the information we have related to the subject of the problem (schema or script). It may also be that we do not have any references with respect to the particular problem. Assuming in the first place that there are such references, we look up each of these references in turn to see whether it provides us with the kind of information that we require to solve the problem. Sometimes we may be lucky and find that a reference (the schema or script) enables us to find an exact solution to the problem. This is either because we have

**Figure 3.5***The index metaphor*

previously successfully tackled and solved the same problem or because we have, at some time, learned and stored information on how to solve this particular kind of problem.

At other times, when an exact fit cannot be found, there may be cross-references under various headings (MOPS) in the mental book which enable us to put together sufficient information (a new schema or script) to solve the problem. The new information (schema or script) subsequently becomes embedded in memory for future reference. In order to make use of the cross-references (MOPS) and formulate the new approach (script or schema) we need to be absolutely clear what it is we are trying to achieve in terms of solving the problem (the main goal) and what constraints (deltacts) we are working under.

The huge mental book is, of course, being constantly updated with new material and adjustments made to the index. New cross-references (MOPS) are also entered. A cross-

reference (MOP) may be entered every time two apparently unrelated, weakly related or unrelated events seem to have a particular bearing on a particular matter. The cross-references (MOPS) may fade with time if they are not subsequently reinforced with evidence to support their usefulness.

Working through the 'mental knowledge book' enables us to solve many of the problems we encounter. Moreover, the speed of access through the index can be very rapid. However, there are occasions when the use of the 'mental knowledge book' may fail us. In the first instance we may be unable to find any entry in the index which is helpful. Second, the complexities of the cross-references may be so large that they exceed the capabilities of our information processing capacity. In either case we may become stuck on a problem.

It is at this point that creative problem-solving aids can be extremely useful. They force us to look up entries in our 'mental knowledge book' which we would not normally consider relevant in the search of the index. For these entries there are no existing recognizable cross-references or, alternatively, the cross-entries are so far down the line of 'looking up' that it would take an immense amount of time and effort to find them.

PROBLEM-SOLVING MECHANISMS

A schema develops because it is a useful and efficient mechanism for solving problems. If there is no problem to be solved, there is no need to give conscious attention to the processing of information and consequently little need to establish memory links among salient features of the current experience. A schema is a goal-orientated cognitive mechanism. The goal is to solve the problem.

A problem can take on a vast number of shapes. It might be a standard problem of the type one commonly observes in educational settings (find this or find that). It might be an internally created problem ('How can I get to the grocery store, the bank and the cleaners before 5 pm?'). For each problem some action needs to be taken, and in many instances a set of goals or subgoals needs to be established and procedures need to be identified for achieving them. Obviously, some problems are more difficult than others and will require elaborate interfacing of multiple schema.

The problem-solving function of a schema is supported by the componential structure of the storage mechanisms. As reported by various researchers, there are many aspects to problem solving, and these include recognizing the problem, making a mental model that fits the problem to some internal representation, forming plans for solving the problem and carrying out the solution. To solve a problem one must ask several questions, such as:

- What exactly is the problem?
- Do I have a frame of reference for it?
- Is it unique?
- Have I solved any problems that are similar to it?
- Have I noted all of its critical features?
- What will I do first to solve it?
- Do I know how to solve it?
- How will I know when I have found a good solution?

ANALOGICAL REASONING

Blevins and Blevins (2009) argue that people are constantly looking for patterns in what they observe and, once they are identified, they are then related to other patterns they have observed and employed to predict further patterns and similarities. The analogical reasoning that underpins them demands the recognizing of structural similarities between what are perceived to be dissimilar elements. Similarities may be highly abstract, involving functional and causal relationships.

Gentner and Colhoun (2010) illustrates an example to explain cell metabolism by analogy with a fire: 'A fire consumes fuel using oxygen, thereby producing energy; it releases carbon dioxide and water. Likewise, a cell's mitochondria obtain energy from glucose using oxygen, in a process called oxidation.' In this analogy Gentner 'highlights the common relational structure that cell metabolism can be seen as the burning of fuel, and fire as a species of oxidation. It also invites the (correct) inference that cell metabolism releases water and carbon dioxide.' Here a familiar situation, a fire burning, is used as an example by which to understand and produce inferences regarding an unfamiliar situation, i.e. cell metabolism.

Gentner (2010) posits that there are five steps one has to follow when undertaking analogical thinking.

- 1 Retrieval: accessing a prior similar or analogous example for comparison with the problem in hand from long-term memory.
- 2 Mapping: aligning the representational structures to derive the commonalities and projecting inferences from one analog to the other.
- 3 Evaluation of the analogy and its inferences.
- 4 Abstraction of the structure common to both analogs.
- 5 Re-representation: adaptation of one or both representations to improve the match.

Retrieval is the most challenging step in the process. There is considerable evidence that similarity-based retrieval, unlike the mapping process, is more influenced by surface similarity than structural similarity. Strong surface similarity and content effects seem to dominate what is recalled. Thus, too often, analogies may be extracted from long-term memory which are inappropriate for the problem in hand, while others in long-term memory are overlooked. It is suggested that one remedy for poor relational retrieval is to make greater use of analogy during learning and reasoning (Gentner, 2010).

Looking at the creative problem-solving techniques illustrated in this book, it is possible to recognize that many of them directly employ analogical thinking in one way or another. It can be appreciated from the foregoing that an appropriate choice of analogy for a problem is critical to whether the technique is likely to produce any useful insights into a problem. The hope is that the facilitator in a group session will give some relevant guidance to group members by suggesting avoidance of analogies that are likely to lead nowhere.

Two systems have been theorized to exist within a person's cognitive structure (Daugherty and Mentzner, 2008):

- (a) the symbolic system; and
- (b) the associative reasoning system.

It is argued that individuals store schemata and employed them in both of these cognitive systems. In the symbolic system we reason about abstract real- world problems and try to solve them with the aid of symbolic representations and rules. Correspondingly, in the case of the associative reasoning system we grapple with problems by making associations with other experiences and information we can recognize or recall. Analogical reasoning is carried out by the latter reasoning system.

In order to make use of the abstractions and prior instances that make up a schema, the individual typically must engage in analogical reasoning. An elemental requirement for using analogical reasoning is that the pieces must fit together in a cohesive pattern. Thus, the cohesion and connectivity of the schema must come into play.

Analogical reasoning allows the individual to map the current experience on to a template that has been derived from previous experiences. This template develops as part of the elaboration knowledge of the schema. The abstractions that are part of the schema make up a basic part of this template, and the individual either consciously or unconsciously will attempt to match each of these with some aspect of the current experience. If the abstractions are not well developed, some or all of the mappings may occur between the memory of a specific previous problem, rather than the more general abstract details, and the current problem.

AN ARTIST'S VIEW OF CREATIVITY

'The method of awakening the Mind to a Variety of Inventions . . . a new kind of speculative invention, which though apparently trifling and almost laughable, is nevertheless of great utility in assisting the genius to find variety for composition. By looking attentively at old and smeared walls, or stones and veined marble of various colours, you may fancy that you see in them several compositions, landscapes, battles, figures in quick motion, strange countenances, and dresses, with an infinity of other objects. By these confused lines the inventive genius is excited to new exertions.'

Leonardo da Vinci, *A Treatise on Painting*

Using analogies in creative problem solving assumes that a problem can be solved with the help of an already existing solution of another problem. Such a process involves the identification of an analogy and the mapping of knowledge from this on to the current problem. The process requires the identification of both surface similarities and structural similarities between the focal problem and the analogue problem. Surface similarity describes the resemblance of the focal problem to the analogue problem while structural similarity may be found if relations between elements of the analogue problem are similar to relations between various elements of the focal problem.

Structural similarity is essential if the analogy is to have any value in helping to solve a focal problem (Blanchette and Dunbar, 2000). The creativity potential of an analogy reflects how dissimilar the knowledge base of the analogy is from that of the focal problem (Dahl and Moreau, 2002). An analogy taken from a distant domain is much more likely to produce paradigm stretching or breakthroughs than one from the domain relating to the problem itself.

Substantial paradigm breakthroughs in road transportation, for example, may be more likely to occur from studying the structure of phenomena in unrelated domains (provided they are relevant) than they are from looking within the current knowledge domains relating to existing forms of transportation.

Finding relevant analogies is not always easy. Moreover, even if relevant knowledge is available, problems may not be solved simply because it is not realized that the existing knowledge is relevant in the context of the focal problem (Hargadon, 2003). Remote analogies in apparently unrelated fields may be difficult to identify because they usually lack surface similarities that would aid their identification. Discovering relevant remote analogies is a complex search problem and can best be aided by the breadth of experience and knowledge of those concerned in the problem-solving process.

The importance of ‘relevance’ is made in clear if we look at the logical arguments applied. A schema for the logic behind analogical inference may be as follows:

- Objects of type 1 have properties A, B, C, etc.
- Objects of type 2 have properties A, B C, etc.
- Objects of type 1 have property X.
- Therefore: objects of type 2 have property X.

However, to reach such conclusions one has to assess the extent to which the properties in the premises are relevant to the property in the conclusion. For example, if one assumes that a relevant metaphor for grooming management trainees is ‘caring for young plants and encouraging them to blossom into full-grown strong plants’, then one has to consider the strength of the analogical argument. Analogical inference may be faulty in several ways, e.g.

- 1 One has to be exact about the meaning of ‘relevant’.
- 2 The logic schema is stated in terms of objects and their properties, hiding the fact that the helpful analogies need to contain causal relations (Holyoak and Thagard, 1995) and that these often determine what is relevant.
- 3 Analogical inference demands a holistic assessment of a potential conclusion with respect to all relevant information.

Modern opinion about creative thinking suggests that it makes use of knowledge or expertise (e.g. Rich and Weisberg, 2004) and effective application of both (e.g. Scot *et al.*, 2005). There are at least three distinct forms of knowledge that might be applied in creative thought:

- 1 *Schematic knowledge* (e.g. Ward *et al.*, 2004)

Schematic knowledge reflects concepts acquired from past experience (e.g. Sakamoto and Love, 2004). Concepts comprise categories where each category serves to organize a set of exemplars of principles or features (e.g. Estes and Ward, 2002) – for example, fish swim and have scales. Schematic knowledge also involves the construction of relationships linking different categories or concepts.

2 *Associational knowledge* (e.g. Gruszka and Necka, 2002)

Associational knowledge reflects regularities in experience based on probabilistic linkages among stimuli and response event nodes (Estes, 1991) – for example, attending a party is associated with having fun. These event nodes are organized in a network structure such that activation of one node serves to activate other related nodes (Boucher and Dienes, 2003).

3 *Case-based knowledge* (e.g. Scott *et al.*, 2005)

Case-based knowledge entails formation of a mental model describing critical aspects of past performance events (e.g. Kolodner, 1997) – for example, planning a shopping trip. Thus, case-based knowledge can be viewed as a form of contextual knowledge that provides a model for action when people encounter similar situations (Hershy *et al.*, 1990). These cases, as a form of mental model, represent a complex entity including information about goals, key actions, outcomes, contingencies, restrictions and potential opportunities (Hammond, 1990). These cases are held to be stored in a library, which includes both prototypic cases and noteworthy deviations from this prototype, with cases being indexed against situational attributes indicating relevance to the situation at hand. The manipulation and rearrangement of the components of activated cases in this library is, in turn, held to give rise to novel problem solutions (e.g. Spalazzi, 2001).

How different forms of knowledge might operate together to make creative thought possible is addressed by Hunter *et al.* (2008). They argue that previous studies have indicated that multiple knowledge structures, schema, associations and cases are involved in creative thought, but few studies have examined how these different knowledge structures operate together in idea generation and creative problem-solving. They report on a study where they found that prompting use of a single knowledge structure, specifically schema or associational knowledge, resulted in the production of more high quality ideas. However, prompting use of multiple knowledge structures, specifically combining either schema or associations with cases, resulted in the production of higher quality and more original problem solutions. They concluded that different knowledge structures appear to contribute to creative thought in different ways depending on whether idea generation or solution formation are under consideration. More specifically, when the criterion of concern was idea generation per se, associational or schematic knowledge appeared more useful than case-based knowledge or various combinations of knowledge structures.

Apparently, people generate ideas most easily when they can work with a single knowledge structure that provides a variety of connections or relationships that are not bound to a particular performance setting. When one considers the quality and originality of solutions to social innovation problems, however, a rather different pattern of findings emerged. Although activation of case-based knowledge did not promote idea generation, it was found to contribute to the production of original, high quality problem solutions. Solution generation, moreover, in contrast to idea generation, appeared to benefit from the application of multiple knowledge structures – specifically, joint activation of associational and case-based knowledge, and joint activation of schematic and case-based knowledge.

Analogical reasoning is based on how directly the given problem corresponds to the problem solver's schemata (Akin, 2001). Where a problem is ill-defined, the problem solver's constant restructuring of the problem is required in the search for an appropriate solution.

QUESTIONS

- 1 'There are no theoretical underpinnings to the creative problem solving process.' Discuss.
 - 2 Explain how the whole brain theory of creativity is linked to the four stages of gaining creative insights suggested by Graham Wallas.
 - 3 What is meant by receptivity, immersion, seeing questions, utilization of errors and detached devotion as being the conditions necessary for the gaining of creative insights?
 - 4 How would you reconcile the different theoretical perspectives – grace, accident, association, cognitive and personality – on creative problem solving?
 - 5 How is the index metaphor a reflection of the cognitive approach to creative problem solving?
 - 6 Differentiate between divergent and convergent thinking. What role do both play in the creative problem solving process?
 - 7 Critically evaluate Mary Henle's conditions of creative thinking. Are they supported anywhere else in other theoretical perspectives? Explain.
 - 8 How relevant is analogical reasoning to creative problem solving? Explain.
 - 9 How relevant are Graham Wallas's thoughts on the concept of incubation in the context of modern thinking on how insights are obtained?
 - 10 Explain the investment theory of creativity
 - 11 How would one try to make sure that an analogy one wants to use is fit for the purpose of gaining insights into a specific problem?
-

CASES

Where did they get their ideas from?

While searching for a way to hear the sounds of the heart, Laennec found his answer when he noticed two boys playing in an unusual way with a see-saw. One was hitting one end of the wooden see-saw with a stone while the other listened with his ear pressed close to the other end. The idea of the stethoscope leaped to Laennec's mind. Westinghouse discovered the idea of the air-brake when he casually read in a journal that compressed air power was being used by Swiss engineers in tunnel building. Kekule gained his clue to the nature of the benzene ring from his dream of a snake swallowing its own tail. Rutherford used the solar system to understand the structure of the atom. He viewed the electrons as revolving around the nucleus in the same way that the planets revolve around the sun. Einstein's theories came from thinking about about riding on light beams and travelling in lifts.

Question

How might one or more of the theories we have discussed in the chapter explain how the above insights were obtained?

Paranoia produces progress

Producing the right kind of culture to allow innovation to take place is essential. This is something that Andy Grove excelled at during his time with Intel. He saw experimentation and readiness for change as needing to be at the forefront of his managers' minds at all times. Indeed, he saw paranoia about these matters as drivers of innovative activity and became known for his guiding motto: 'Only the paranoid survive.' He even wrote a management book with the same title (*Only the Paranoid Survive* (1996), Doubleday, p. 65). In his view, 'Business success contains the seeds of its own destruction,' inferring that 'Success breeds complacency. Complacency breeds failure. Only the paranoid survive.' (Jeremy Byman (1999). His message to senior executives is to allow people to test new techniques, new products, new sales channels, and new customers, to be ready for unexpected shifts in business or technology (*Industry Week*, 15 December 1997, Technology Leader of the Year Andy Grove: Building An Information Age Legacy, IndustryWeek.com).

Question

How does Andy Grove's approach fit in with Mary Henle's five conditions of creativity?

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Problem solving and improvisation

The chapter concentrates on problem solving issues before going on to look specifically at creative problem solving itself. The chapter presents a model of problem solving which is put together on the basis of searching the literature on the subject. It then goes on to look at the three types of problems that are encountered and points to how these are tackled in practice. Ill-structured problems in particular are highlighted since it is these types of problems that are best suited to creative problem solving. In addition to being ill structured they are often very complex in nature. After reviewing a common-sense approach to problem solving, the chapter explains the *ideal* approach put forward by Bransford and Stein. This background to general problem solving is then followed by an introduction to the creative problem solving process. Specifically, the six-stage process and the nine-stage process of creative problem solving are examined and the latter illustrated with an example. The chapter then moves on to look at the important trend towards improvisational creative problem solving, discussing practical and theoretical issues. Lastly, consideration is given to some of the limitations on formal problem-solving approaches.

PROBLEM SOLVING

Van Gundy ([1981] 1988: 3) believes ‘a problem can be defined as any situation in which a gap is perceived to exist between what is and what should be’. Based on this definition, a problem solving process is one whereby a situation that is not as it should be is changed into one that is as it should be.

However, it should be noticed that not all problems require the use of a creative problem-solving (CPS) process. Indeed, in some cases a CPS process would not be as useful as an existing routine or ready-made solution. These kinds of solutions generally exist for recurring problems, and when it is possible to use one it is often much quicker and more practical.

A problem exists when an individual has a goal and a choice of means by which it might be achieved, but does not know how to proceed immediately. The psychology of problem solving deals primarily with intellectual problems: those that can be solved mentally or by manipulating symbols. It uses three principal methods: (1) examining what scientists, mathematicians and others have said about their own activities; (2) presenting test problems to experimental subjects, noting the effect of various conditions on the likelihood that the problems will be

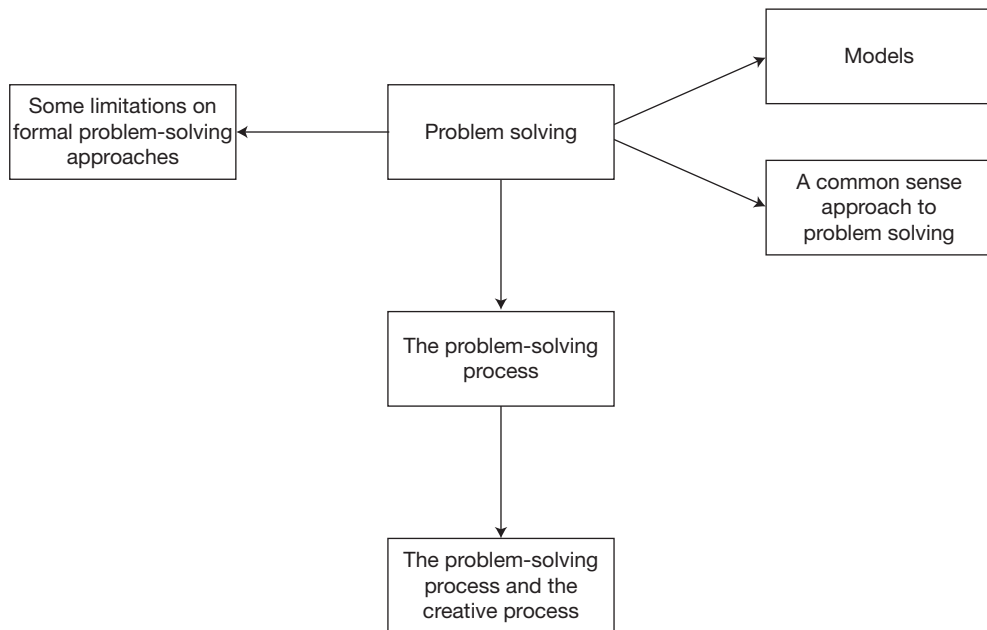


Figure 4.1

Overview of Chapter 4

solved; (3) asking individuals to ‘think aloud’ as they solve problems, and devising theoretical models to explain the sequence of steps that typically appears in such reports.

The testimony of scientists and others indicates that the processes of problem solving are not entirely open to consciousness. One may begin by reasoning consciously and deliberately, but the solution often comes in its own time, suddenly and ‘out of nowhere’. As noted earlier, Graham Wallas (1926) described such a problem solving sequence as consisting of four stages: *preparation*, in which the individual defines the problem for himself or herself and explores various possibilities; *incubation*, when attention is turned to other things, and the problem disappears from consciousness; *illumination*, when the solution suddenly appears; and *verification*, in which the new solution is checked to see if it will work. Of course, this sequence does not apply in every case. Moreover, Duncker (1945) noted that every phase of a solution is essentially a productive reformulation of the original problem.

The mathematician Gyorgy Polya introduced the idea that there are general techniques for solving problems, which he called ‘heuristics’ – procedures that often help though they cannot guarantee success. One useful heuristic is working backward from the solution: if the answer were known, what characteristics would the problem possess? Another important heuristic is to establish subgoals: think of some situation from which it might be easier to obtain the solution, and work towards that situation first. Still another is means–end analysis: establish lists of methods that are useful for attacking various kinds of goal or subgoal and work through the list systematically.

Recent research on problem solving has involved computer programs that enable a computer to solve difficult problems. If the sequence of steps taken by the machine is similar to the sequence reported by human subjects who think aloud, the program itself can be regarded as a theory of the problem solving process. The programs developed go through the same sequences of steps (and make the same sorts of errors) as people who are thinking aloud; thus they probably incorporate many of the principles that govern human problem solving.

MODELS

It is useful to put together a general model of problem solving as a prior step to looking at the process of creative problem solving. Problem solving occurs in a multitude of domains and it is perhaps not surprising therefore to note that numerous models appear in the literature to describe the process. In addition, the decision-making literature is also replete with models reflecting interest in the subject in different domains. I have put together the model below (Figure 4.2) to reflect some of the various thoughts and ideas that exist on the matter.

The model indicates that individuals or organizations are constantly scanning their environments. During the scan process they may detect a problem which they feel merits attention. The problem can be any one of a number of types.

Types of problems

There are three types of problem.

- 1 *Well-structured* – straightforward, familiar to the decision maker, and the goal is clear, the information about it is complete.
- 2 *Ill-structured* – new/and information about such is ambiguous or incomplete.
- 3 *Programmed* – where the solution is a repetitive decision that can be handled by a routine approach (procedure, rule, policy).

The next step is to properly define the problem before going on to specify and operationalize the goal that needs to be achieved in order to solve the problem. It is anticipated that there may be a number of possible solutions to the problem and one will need to have established decision criteria to enable choice to be made among them. However, it will be necessary first to undertake a search to enable the alternative solutions to be identified. Search may be made on an *internal* or *external* basis and may be *local* or *distant* in nature. Internal search implies searching people's memories while external search implies looking further afield and consulting papers, books, journals and even consultants. In the case of *internal* search there is a tendency to search at a *local* level or in the area of the problem in the first instance since this will produce solutions quickly if any are to be found. More distant search means looking away from the immediate problem to see if one can locate anything in another domain that may give an insight into the problem.

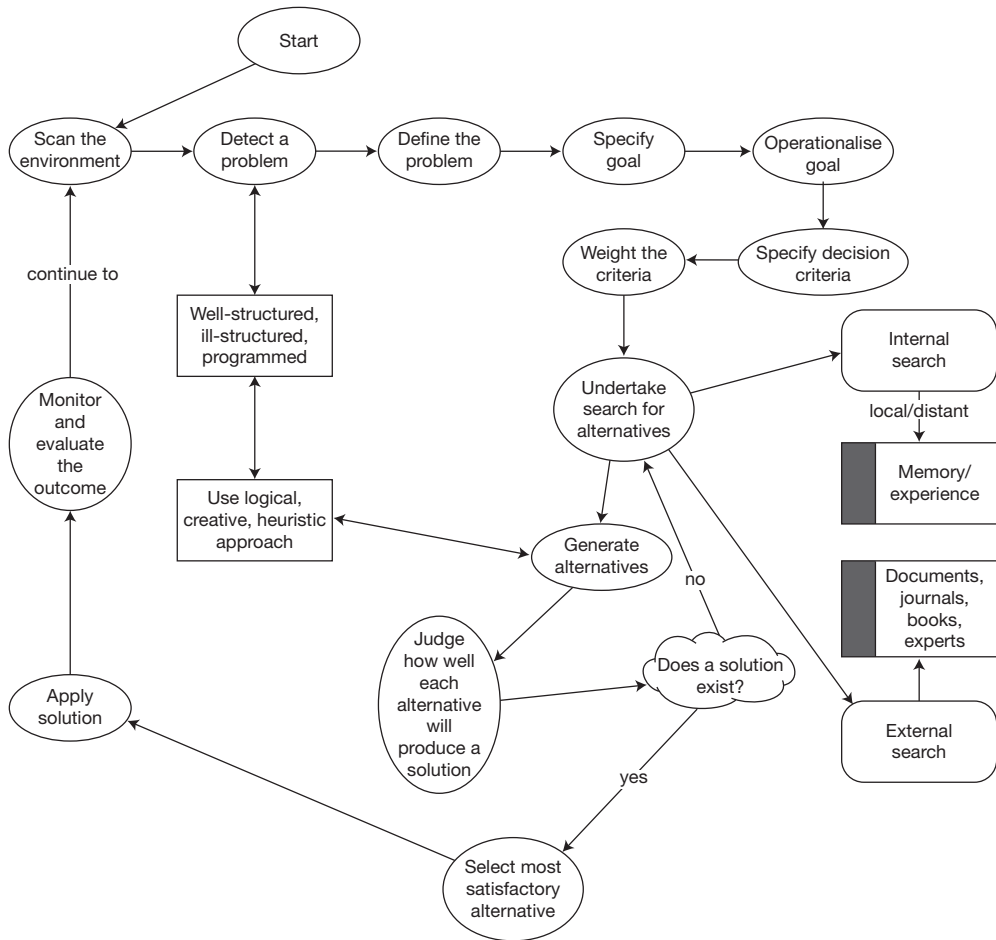


Figure 4.2
A model of the problem-solving process

The search should generate alternatives and may be aided by the creative problem solving techniques in this book in the case of ill-structured problems or by the use of heuristics in the case of programmed problems. In the latter case there are many different kinds of heuristics that may be used (see Kahnemann, 2012). Three major heuristics that are used are as follows.

Representativeness

The more object X is similar to class Y, the more likely we think X belongs to Y. People predict future performance mainly by similarity of description to future results. For example, when seeking to appoint a new employee's predicting future performance as a manager based on a single reference or interview with the person concerned.

Availability

The frequency of a class or event is often assessed by the ease with which instances of it can be brought to mind. For example, when reviewing the number of expense claims and looking for ways to reduce them one may more easily recall large claims when these are very much in the minority and have little impact on the overall total of expenses claimed.

Anchoring

People often estimate by adjusting an initial value until a final value is reached. The approach may characterize wage settlements.

The next step in the process is to judge the most satisfactory solution to the problem, implement it and monitor how well it serves to provide a solution to the problem. If a satisfactory solution cannot be identified, then further search has to be undertaken and the latter part of the process repeated.

A common-sense approach to problem solving

Common sense would seem to dictate that a systematic approach is by far the best thing to do. One really has to approach with an eye on the context since the same problem may require a different approach in another situation. One only has to think of how one tackles one's colleagues about different issues to realize that problem solving is contingency based – that is, it varies from situation to situation.

Another important point is that one should never rush to conclusions. Although some problems may seem to require urgent attention it is better to weigh up alternative causes and outcomes before rushing headlong in. However, if a decision has to be made there and then at that moment in time, delay may not be possible. Where one has to time to reflect for a period of time before needing to implement a solution it is often quite surprising how what is done may differ from the initial diagnosis of the problem.

There are usually a number of steps one has to follow when taking a common-sense approach to solving a problem.

The first step is to ensure that one has correctly identified the problem. This may seem unnecessary yet too often mistakes may be made because the problem has been wrongly diagnosed. In the field of medicine we sometimes hear of wrongly identified breast cancers and subsequent operations which are totally unnecessary. The results of such actions are commonly quite devastating for the patients. So this is a critical step and needs a great deal of care and attention.

Sometimes one may see multiple problems in a situation. These may vary in terms of importance from critical to relatively minor and having only low priority as far as the owner of the problem is concerned. It is essential to solve the right problem and one should avoid trying to solve a problem that is seen as low priority or unimportant.

One should seek to identify the problem by asking the right sort of questions or making best use of one's own powers of observation. Alternatively, there may be special tools, procedures, or even skills that one may need to call upon to ensure that no mistakes are made at this point. In the course of medical diagnosis, for example, GPs conduct initial interview

and examinations of patients and where they consider it necessary they will refer patients to specialists who can make expert diagnosis of a problem. The experts in this instance may make use not only of hi-tech apparatus but also their specialized experience gained through years of research and previous encounters with similar cases. In a more general sense it is usually important to explore with the owner of the problem what is leading them to feel there is a problem. One needs to ascertain whether it is something specific, or whether it is an intuitive sense that things aren't as they should be. Getting the owner of the problem to define the problem – with help if necessary – is reassuring for all concerned.

The next step is to analyse the problem. One needs to ascertain how often the problem occurs. Does it happen regularly or only occasionally? Just how inconvenient or severe is the problem? Can one identify the circumstances when the problem arises? Is there anything about these circumstances which is unusual? Answers to these questions might give one a clue regarding what might be the causes of the problem. Knowing how long it has been going on and whether it has become worse may also assist in making a correct diagnosis of the problem. Problems often affect other processes or people, so exploring this angle can also often be productive in helping to make a correct diagnosis of the problem.

Once these steps have been taken, a decision may need to be made about dealing with the problem. If there seems to be more than one way of dealing with the problem, then it may be necessary to identify the alternatives and then specify decision criteria. Where a number of criteria have to be satisfied it will be important to decide how to weigh the criteria.

It is important to have thought through more than one solution to a problem where this is possible. Terminating the search procedure at the first solution that is identified may be good, but much better solutions may still exist.

When one is confident that one has reached a point where there are diminishing returns to be had from further search it is necessary to evaluate the options that have been identified. One needs to assess the advantages and disadvantages of each option carefully.

Finding an optimal solution to a problem may be elusive. In many cases it is difficult to determine with any real degree of certainty whether one has found an optimal solution. Often it is a case of selecting the most satisfactory solution. This is referred to as satisficing. Such a solution generally meets all or most of the criteria one has previously set up and scores higher than any of the other alternatives.

Lastly, one has always to allow for contingencies. Despite one's best efforts and selecting a good solution, it may not solve a problem for some reason that one has overlooked. It is therefore important to have several back-up solutions as well – just in case.

Various approaches of the problem solving process have been proposed and one of these is shown next.

THE PROBLEM-SOLVING PROCESS

Bransford and Stein (1993) proposed a model for improving problem-solving skills. It is based on research in the field of problem solving by such people as Wertheimer ([1945] 1959), Polya (1957), and Newell and Simon (1972). The components of the approach are represented by the acronym IDEAL, where

I = Identify problems and opportunities.

D = Define goals.

E = Explore possible strategies.

A = Anticipate outcomes and act.

L = Look back and learn.

Identifying problems and opportunities

The argument is that one should identify potential problems and treat them as opportunities to do something creative. It is just as important actively to look for problems as simply to respond to them when they become critical or when they are noticed. Actually identifying problems and then treating them as opportunities in the dimension of strategic management can lead to the establishment of a strong competitive advantage.

Bransford and Stein (1993) quote the example of a friend who for years had never questioned the fact that he often got splattered with grease when he fried bacon. One day while looking through a mail-order catalogue he found a device that protects cooks from hot, splattering grease – effectively a fine wire mesh with handle to place over the frying-pan during cooking. What impressed their friend more than anything else was not the invention itself but the fact that someone had actually identified the problem in the first place and viewed it as an opportunity. The friend had never thought explicitly about the fact that splattering grease signified the existence of a problem that, once identified, might be solved.

Defining goals

Different goals often reflect how people understand a problem. For example, the problem of lack of strategic direction in the business could be identified. All concerned might agree that it could represent an opportunity to do something creative. However, people could disagree on what the goals should be. Some people might argue that the objective of the business should be growth in one direction while others might argue for growth in another. In each instance the goals clearly reflect how different groups perceive the same problem. Defining the goal is thus a crucial step in moving towards a solution to a problem.

In practice, people often do not consider alternative goals but move straight to the exploration of strategies. Under these circumstances, strategies may well be generated which lead to the solution to a given problem, but deciding which one to choose then becomes a difficult problem. Moreover, if goals have not been specified, solution strategies that are generated may not provide acceptable answers to a problem. A simple illustration is found in the case of a small firm wanting to appoint a replacement secretary for the owner of the business. The former incumbent of the position decided to retire after many years of service. The problem identified itself to the owner and he placed an advertisement in the local newspaper for a replacement secretary. This was done, and in due course six candidates with good secretarial qualifications were interviewed for the position. None of them could be appointed because none of them appeared to be able to do what the managing director was looking for. What he wanted was someone who could really deputize for him when he was away on business – clearly not the job for a secretary but, because of years of experience and a willingness to take

responsibility, one that the previous holder of the post had taken on. What he really wanted was a deputy and a secretary. Had he defined the goal as having someone who could deputize for him while he was absent, the solution would have been obvious.

Exploring possible strategies

This involves re-analysing goals and considering options or strategies that might be employed to achieve those goals. In many instances it is easy to consider all the relevant information without experiencing a strain on short-term memory capacity. As problems increase in complexity, this becomes more difficult to do. Experienced problem solvers often keep track of information by creating external representations. Rather than trying to keep all the information in their head, they write it down on paper – or in some other medium. This allows them to think more freely about the problem they want to solve. There are many ways of recording and analysing a problem: graphs and Venn diagrams are examples; see also mind maps in Chapters 9 and 10. The most effective way to represent information depends on the nature of the problem. Hayes (1989) and Halpern (1989) suggested that some problems are more readily solved if one uses verbal representation whereas others may be better represented visually or even mathematically. Other additional general approaches, which are good examples, include: working a problem backwards, or focusing on a simpler, specific situation, building scale models or performing experiments that simulate certain characteristics of a real-world environment.

Although there are general strategies for solving problems, specialized knowledge is often necessary in some cases. For example, we may know how to set about gathering market-survey data, but the actual designing of a questionnaire that will enable the data to be collected requires expert knowledge and skill to construct.

Anticipating outcomes and acting

Following the selection of a strategy, contingency plans should be drawn up and the strategy implemented. Often, an active role in testing strategies has to be taken before possible outcomes can be anticipated. The building and testing of a prototype, for example, can often help anticipate the outcomes of particular strategies.

Looking back and learning

The last component of the IDEAL model is to look at the effects of the particular strategy and learn from the experience. When trying to solve a problem the emphasis should be on finding the *first* step rather than on trying to find a complete solution immediately. Having tried out the first step and learned from the experience, one can then proceed to work through subsequent steps. Test marketing is a case in point, where the launch of a new product is done on a gradual basis. Any aspects of the introduction that are less than satisfactory are corrected before the next stage in the roll-out process. Writing and debugging computer programs follows a similar process.

New insights customarily emerge as a product of various pieces of knowledge becoming connected for the first time (Geschka and Reibnitz, 1983). It tends to be an evolutionary process where two or more pieces of retained knowledge meld together and then form new insights. This is also true with breakthrough ideas. The knowledge may reside with different people and it is only when they come together and share the knowledge that insights arise. Although an innovation can be based on a new scientific or technical discovery, the recombining of knowledge of the nature of innovations is more common (Hargadon, 2002, 2003).

However, finding a way of melding existing knowledge in the hope of discovering a breakthrough may require very extensive search. Human mental processes use bounded rationality, reflecting limited cognitive ability, so the field of search and extent of search is limited (Simon, 1957, 1982, 1996). Since search tends to be local and in the area of the problem, finding and retrieving material from very distant domains of knowledge is often constrained by established thinking patterns. The majority of people have difficulty in thinking outside of their area of original expertise, because this usually requires them to use a different way of thinking and a different technical language than they are used to (Terninko *et al.*, 1998).

THE PROBLEM-SOLVING PROCESS AND THE CREATIVE PROCESS

We have suggested earlier in this chapter that problems that are ill-defined or where the route to finding a solution is not obvious it may require a creative approach to be taken (Finke *et al.*, 1992). Clarifying how to resolve a problem involves gaining insight (Mayer, 1995). However, what is insightful for one individual may not be insightful for another (Davidson, 1995). Moreover, a problem that is solved creatively by one person may be solved more routinely by another if the problem solver has had experience with similar problems (Davidson, 1995). It all depends on the cognitive processes used by the problem solver (Davidson, 2003). When a problem needs insight it means that the problem solver has to change his or her customary mode of thinking in order to make sense of it. While such problems may not be commonplace they tend to have confusing characteristics that make it difficult to access and use prior knowledge that is relevant to the finding of a solution. Indeed, their very ambiguity often produces inappropriate assumptions in interpreting them.

One way of theorizing about problem solving is to see it as involving processing information. Conceptualizing problem solving in this way, Newell and Simon (1972) argued that it is a three-stage process.

- 1 *Recognizing the task environment.* First, one perceives the events, interprets these events and recognizes the nature of the task – e.g. notice disquiet in the office and see that the task is to identify how the disquiet can be resolved.
- 2 *Transformation into the person's problem space.* Next one views the task in a specific way. Here one has to be quite specific about the goal – what has to be done, where one stands in relation to the goal, and what kinds of action are needed in order to reach the goal. For example, from experience one will know that one cannot jump to any quick conclusions about the source of the disquiet in the office but will know how to set about finding the source of the disquiet.

- 3 *Processing the data and moving towards the goal.* Depending on how the problem space has been conceived, one uses various kinds of information given with the problem or drawn from memory to process the data so as to move towards the problem solution. For example, in the illustration one will have had experience of diagnosing problems of unrest in the office and will be able to call upon this experience along with information noted which is specific to the current situation.

In the course of working through the above steps – called ‘following the programme’ – the problem solver will notice whether any of the steps or series of steps he or she makes reduces the distance to the goal – i.e. resolving or solving the problem. If this seems to be the case, then the problem solver will continue with that line of enquiry. If the steps do not seem to be productive, then alternative steps will be followed. Progress and search for solutions are related to constant feedback of information obtained from people and objects in the problem situation. If the entire search programme fails to achieve the objective, then the problem solver either quits, or modifies the programme, or changes the problem space.

The conclusion that might be drawn from the analysis offered by Newell and Simon is that problem solving involves the search for the most successful programmes. However, as Minsky (1974) argues, successful problem solving may not so much be a search for a successful programme as a search for the best problem space. It would seem, however, that both are required to increase the likelihood of finding good solutions to problems.

Success in finding solutions to problems will be enhanced by:

- 1 Correct perception of the task environment – positive mindset.
- 2 Correct specification of the problem space – creative problem solving techniques may help with this.
- 3 Having sufficient but not too much information to assimilate. More or better information-gathering procedures or the use of creative problem solving methods may assist in this case, too.

Insights and how they arise

One might, indeed, think of ideas as ‘the sentences of thought’. Ideas are mental phenomena that somehow drift into the mind, wander through and often vanish into obscurity, never to be recalled again. Making notes on ideas as they arise is extremely important. Graham Wallas (1926) tells the story of a man ‘who had so brilliant an idea that he went into his garden to thank God for it, and found on rising from his knees that he had forgotten it, and never recalled it’.

In terms of problem solving we might prefer to think of ‘insights’ rather than ideas. The gaining of insights into a problem can lead to a restructuring of that problem and the development of further insights into the solution of the problem. There may not be a perfect solution to a problem that requires creative thought but only different solutions, more acceptable solutions and, often, only further insights into a problem.

Many ideas seem to occur by chance. Fleming discovered the effects of penicillin quite by accident – it was blown in from an open window and killed bacteria in a saucer that contained

a strain he was investigating. However, generating ideas is not just a chance process. Ideas appear to arise by chance only when people are actually looking for ideas. It does not happen to people who are not curious or enquiring or who are not engaged in a hard search for opportunities, possibilities, answers or inventions.

It is also widely recognized that immersion in one's subject matter can be an important factor in gaining creative insights. Newton, for example, arrived at the law of gravitation by being preoccupied with the problem all the time. It is also known that Einstein tried for years to clarify the problem of the relation of mechanical movement to electromagnetic phenomena. Creative insights appear to be easiest to gain in fields where we have considerable prior knowledge and experience. Nevertheless, there is a paradox here, for we tend not to think about what we think we know already. Existing ideas tend to make us myopic about new possibilities. The paradox reveals itself in that it appears that creative ideas do not come to us unless we spend much effort engaged in just the activity which makes their emergence most difficult.

Motivation also plays an important role in our ability to be creative. Again there is a paradox, for creative work demands both a passionate interest on the part of the thinker and a certain degree of detachment from the work and ideas. Creative thinking, however, does not appear to occur where the individual's interest in the subject matter is relatively low. There seems to be a delicate balance whereby the creative thinker has to remain sufficiently detached from the work.

Byrne *et al.* (2009) argue that creative work can occur in any job that involves a particular kind of task. They suggest that task must present complex, ill-defined problems where successful performance depends on the generation of novel, useful solutions. In this context the capacity to identify problems and opportunities is one of the most important steps in the creative process. The art of defining and redefining one's goals is particularly important since different goals suggest different lines of thought and have a powerful effect on the solution strategies that are considered. The anticipate-and-act phase of the IDEAL model can help us uncover inappropriate assumptions that may be limiting the creativity of our thinking. Functional fixedness and mindset prevent people from solving a problem because they assume it requires routine thinking. Long-term efforts to enhance creativity will not be successful unless one looks at the effects of one's actions and tries to learn from them.

It is generally accepted that the creative problem solving process can be broken down into six stages. These six stages are:

- Objective finding – define the problem area.
- Fact finding – gather information.
- Problem finding – define the problem correctly.
- Idea finding – generate solutions to the problem.
- Solution finding – evaluate and choose between possible solutions.
- Acceptance findings – implement chosen ideas correctly.

(Parnes, 1992)

Each of these stages involves activities that require first divergent thinking and then convergent thinking. When thinking in a divergent way, the task is to generate as many ideas and solutions

as possible. There should be no limits to the ideas that are formed at this stage. Once a satisfactory level of ideas has been reached, convergent thinking must take place. The purpose of this thinking is to focus on obtaining solutions to the problem based on the ideas from the divergent thinking. These activities can be thought of as filling a funnel with ideas that go through a filter. Plenty of ideas are poured in, but only those that are useful and relevant come out.

The six-stage process may be extended by the addition of further stages:

- constantly analysing the environment;
- specifying assumptions;
- controlling to ensure that objectives are achieved post-implementation.

THE SIX STAGES OF THE CREATIVE PROBLEM SOLVING PROCESS

The six stages are 'objective finding, fact finding, problem finding, idea finding, solution finding, acceptance finding'. Within each stage both divergent and convergent thought processes are used: essentially this is the search for data and then the narrowing down of data. During the convergence, 'one looks for material which is either very close to the point of issue or close enough to warrant further consideration'. Specific items that are identified as important or relevant to a particular stage are known as 'hits'. Clusters of 'hits', which are related to one another, are known as 'hotspots'.

The objective-finding stage essentially involves divergent thinking to generate a list of problems. Convergence is then used to identify the most relevant problem areas for further exploration. 'Hits' and 'hotspots' are identified by questioning ownership (is one motivated to solve it), priority (how important is the problem) and critical nature (how urgent is it to solve this problem).

Next is the fact-finding stage, where overall comprehension of the problem is increased by collection of relevant information. This also helps new ideas to be generated. 'Hits' and 'hotspots' can assist convergence here. The previously identified problem(s) may now be seen from a new perspective.

Problem finding essentially uses the previous-stage 'hits' to identify the most productive problem definition possible.

Idea finding helps to structure the search for potential solutions. Mainly divergent activity is used to generate many ideas using a variety of idea-generation aids.

Solution finding is basically the choice of ideas that can be transformed into workable solutions.

The final stage of acceptance finding is primarily a divergent activity that helps to implement solutions successfully via:

- 1 listing potential implementation obstacles and ways to overcome them;
- 2 developing both preventive actions and contingency plans;
- 3 generating an action plan to implement a solution.

A NINE-STAGE PROCESS FOR CREATIVE PROBLEM SOLVING

- 1 Constantly analysing the environment to find potential problems.
- 2 Objective finding – define the problem area.
- 3 Fact finding – gather information.
- 4 Problem finding – define the problem correctly.
- 5 Specifying assumptions.
- 6 Idea finding – generate solutions to the problem.
- 7 Solution finding – evaluate and choose between possible solutions.
- 8 Acceptance finding – implement chosen ideas correctly.
- 9 Controlling to ensure that objectives are achieved *post-implementation*.

The extended process is shown above.

It is not always necessary to execute the entire process. Each stage is individual, and in many circumstances some of the stages need not be implemented. For instance, it is very often the case that we are presented with a problem without having to look for one, or sometimes the best solution is easily apparent without the need to evaluate all the ideas.

Example of the nine stages approach

- 1 Salesmen of firm X regularly feed back information regarding competitors' activities in the marketplace.
- 2 New competitor is reported to be operating in some areas. Salesmen report that some action may be necessary to prevent the loss of substantial numbers of customers to the new entrant to the market.
- 3 Further reports indicate that the new competitor is a large multinational company wanting to muscle in on the rapidly expanding demand from customers for the firm X's main line of business.
- 4 Further research shows that the new entrant is likely to be able to offer the products at substantially lower prices than it costs firm X to make them.
- 5 Firm X executives assume that the new competitor may seek to undercut firm X on price by around 5 per cent.
- 6 Firm X executives decide not to compete on price since they feel a price war would be disastrous under the circumstances. Alternative courses of action are:
 - (a) Do nothing.
 - (b) Offer larger discounts for big orders and/or early settlement of invoices.
 - (c) Seek to differentiate the product through marketing communications via distributors stressing the difference of firm X's product from that of the new competitor in being able to satisfy customer wants and needs.
- 7 Combination of options (a) and (b) above selected as the most satisfactory solution.

- 8 Informing salesmen and distributors of the proposed strategy and securing their cooperation to implement the response.
- 9 Monitoring how successful the chosen response is in the light of subsequent performances by firm X and the new competitor in the marketplace.

COMPOSITIONAL AND IMPROVISATIONAL CREATIVITY

The idea of ‘emergent’ strategy was put forward by Rosabeth Moss Kanter (1983). Based on empirical research she promoted the ‘improvisational’ model whereby improvisers invent strategy by exploring new possibilities they create as they interact with their audience. Speedy response is more important than early perfection. Many problems that occur do require instant and immediate attention. Under these circumstances an immediate response is required. An aggressive and frustrated customer exhibiting threatening behaviour is a case in point. Usually, most organizations will have set procedures laid down for dealing with such situations and similar ones as well. However, there may be times when problems that arise are totally unexpected and not anticipated. In such situations one may be called upon to improvise a solution. By and large organizations will try to anticipate as many of these situations as possible and will have set down set procedures for dealing with them. However, even in anticipated situations something may arise that had not been foreseen. Disasters involving nuclear power stations are a case in point. Terrorist attacks on buildings are another example. But even in the run-of-the-mill operation of business the unexpected may raise itself without prior notice. Such situations may require new insights to be generated very rapidly. Improvisation facilitates problem solving when time is of the essence (Vendelo, 2009), or when it is essential to implement solutions quickly (Leybourne and Sadler-Smith, 2006).

Nor are emergencies the only occasion where improvisational creativity can prove useful. Indeed, quick innovative decisions enable firms to be competitive (Tellis *et al.*, 2009). While being market oriented and designing products and services that are well researched and information based is extremely important, a combination of planning and improvisation is even more so. The speed of getting new products and other product innovations to market can be of the essence in establishing a competitive advantage. While the test marketing of new ideas is traditionally advocated to safeguard against avoidable commercialization blunders, firms often bypass this activity fearing competitors’ use of reverse engineering to quickly produce competitive offerings themselves. Competitors are quick to improvise and imitate each other’s offerings in the marketplace.

Improvisational creativity is a strategic tool that can be employed widely in business to good effect. Its use in exporting is a good example of this. A study (Nemkova *et al.*, 2012) argues that export improvisation is extremely common and used to advantage when implemented in conjunction with planning. This study suggests that this is commonplace within export departments, and that exporters have potentially much to gain from understanding improvisation and using it alongside traditional export planning.

Fisher and Amabile (2008) distinguish between *compositional creativity* and *improvisational creativity*. The former is conceptualized as being the standard view on creativity and reflects the manifestation of creativity in organizations in the form of such processes as new product

PROBLEM SOLVING AND DECISION MAKING IN A CRISIS

In real life we find that the identification of one problem often leads to the need to identify others that are associated with it. We find that we may have not just to solve one problem and make one decision but we have to deal with the other associated problems and decisions, too. Moreover, the problems are often interdependent and how we try to solve one will affect how we try to solve the others. Consider the following situation.

Oldenborough is a city of some 600,000 people in the north of England. It is surrounded by moorland punctuated by valleys that cut into the hillsides of the moors. In the past the rivers that run through several of the valleys have been dammed to create reservoirs for the expanding city. All the reservoirs lie within four miles of the city centre. The dams are regularly inspected to ensure that they are structurally sound and that the sluice gates work effectively.

John Broadhurst is in charge of the inspection team and on this occasion around 9.00am one day in January is inspecting the large Olden Valley dam, which holds over 600 million gallons of water. There have been some very heavy gales overnight and waves on the surface of the water have been whipped up very high. As he reaches the centre of the dam he notices a crack about 5in wide running horizontally for about 15yd along the surface of the dam some 20ft below the top of the dam wall. Since it is the middle of winter he assumes it has probably been caused by frost – it has been an exceptionally cold winter.

His assistant, Lucy Braid, suggests that it might be worth opening the huge sluice gates at the bottom of the dam to lower the level of the water in the dam just as a precaution while he has time to make a better assessment of the crack that has appeared. John agrees and orders other member of his team to get across to the dam as soon as possible to do this. The weather is brewing up for a storm and heavy rain is expected to fall locally within the hour. By 9.15am the sluice gates are fully open and water is starting to pour out through them. At 9.30am heavy rain starts to fall, and weather forecasters predict that it will be a strong, slow-moving storm, which will produce heavy rain.

John puts one of his men on the dam to watch for and report any problems. The man sees water pouring a good 3ft over the overflow channel. By 1.00pm, 6in of rain have fallen over the previous three and a half hours. The water level in the dam has fallen but the crack John noticed earlier has now doubled in length and seems to be around 7in wide. Several other smaller cracks have also now appeared. John estimates that the reservoir is still holding over 90 per cent of the volume of water it had at 9.00am.

Questions

- What do you see as the central problem?
- What decision points did you identify in the case study?
- How might early decisions affect later decisions?

See Appendix 2 for author comments.

creation. In other words, where there is a planned process whereby an idea is taken through step-by-step stages of development. *Improvisational creativity*, on the other hand, occurs more spontaneously and usually in response to crises and unexpected opportunities. It is reflective of the musical situation where improvisation differs from composition. The development of improvisational creativity in the organizational context is seen to be aided by having available the relevant expertise, creativity relevant processes (such as responsiveness to temporally proximate stimuli and risk orientation), intrinsic motivation (seeing it as a positive opportunity) and a work environment that favours flexibility and experimentation.

As noted above, improvisational creativity requires expertise (Weisberg, 1999). This implies having knowledge acquired from experience or in some other way that can be quickly accessed to provide the required skills to improvise quickly in a situation. Having the knowledge and an efficient and effective means of accessing the knowledge are thus key elements of the process. Clearly, these are also important characteristics of compositional creativity, too, but in the case of improvisational creativity time constraints and perceptual acuity may constitute effective barriers to its effective exposition. In other words, time pressures and the inability to respond to critical considerations may stymie the development of potentially beneficial opportunities that can be capitalized on by improvised creative thinking.

Greve (2008) argues that creativity depends on opportunities that arise from a conjunction of social networks and knowledge development that create opportunities to create technologies. Set networks are seen to open opportunities for creative minds to interact with others and combine resources to create new technologies. In a more general setting, Castells (2000) argues that modern societies are influenced both by new forms of communicating and networking provided through the Internet and traditional cultural, religious, social, economic and political factors. He argues that modern society is a network society comprising social networks that process and manage information using electronic-based technologies and face-to-face encounters.

The creative problem solving techniques suggested in this book, along with the notions of approaching management problems with a creative outlook as suggested in *Lateral Thinking for Management* by Edward de Bono (see Chapter 8), may help managers to take advantage of situations that can benefit from improvisational creativity.

SOME LIMITATIONS ON FORMAL PROBLEM-SOLVING APPROACHES

As we have seen in this chapter, problem solving techniques specify a series of steps that have to be taken in order to arrive at a solution to a problem or to generate insights into it. The steps follow the pattern of:

- Define the problem.
- Determine what factors influence the observed dysfunction.
- Specify possible options that will provide a solution.
- Decide what options will be acted upon.
- Determine the preferred contingency plan.
- Carry out the chosen action.
- Monitor the results.

In practice, however, problem solving is not usually quite so linear in nature. It is commonplace for there to be detours, dead ends, reiterations, jumps and so forth in the path from problem to solution (Isaksen *et al.*, 1994). Such occurrences are almost inevitable and are to be expected – they are a normal part of the process. Formal techniques need to be adapted to be flexible enough to cope with such diversions. Indeed, in an organizational setting formal methods can be an excellent tool to employ. Many problems situations seem initially so complex and difficult to get a handle on. The formal approach enables one to get on with problem solving straight away. In modern organizations where working in groups is the norm, formal methods enable everyone to follow what is going on and how much progress is being made.

The context of problem solving

Where the problem solving process seems to fall down is that the most frequent cause is not in the problem solving effort itself, but rather in the critical steps that lead up to the problem solving (Talley, 2013). The critical steps concerned involve:

- (a) identification of what issues are to be considered as ‘problems’ to solve;
- (b) exploring and finally deciding on how to think about the problem;
- (c) assigning responsibility, naming the team, allocating resources, setting the schedule and naming key stakeholders;
- (d) the actual effort to solve the problem, understand its cause, design some corrective action, and implement the solution.

(Talley, 2005)

Talley (2013) states that after observing hundreds of problem solving efforts in a wide variety of settings he has found the most common ‘problem solving discussion’ is actually a debate over proposed solutions. One has to be aware of the hazards faced in such a situation. These are aptly summarized in the phenomenon of the *Abilene Paradox and Other Meditations on Management* (Harvey, 1996) where groups in organizations take actions in contradiction to what they really want to do and therefore defeat the very purposes they are trying to achieve. Symptoms of the paradox include the inability to manage agreement and not the inability to manage conflict. This is reflected in organization members individually agreeing in private about the nature of the situation or problem facing the organization and what steps would be required to cope with the situation or problem. However, the group members do not accurately communicate their desires and/or beliefs to one another, thereby leading one another into misperceiving the collective reality. Under such circumstances group members make collective decisions that lead them to take actions contrary to what they want to do.

QUESTIONS

- 1 Using the common-sense approach to problem solving, show how you would deal with the following situations:
 - (a) Major fire on the first floor of a five-storey office block.
 - (b) Discovery of irregularities in expense claims of several of the firm's travelling sales staff.
 - (c) Several cases of sexual harassment in the offices by departmental managers.
 - (d) Finding new offices for an expanding back office of employees.
- 2 How does the procedure recommended by the Bransford and Stein model differ from the common-sense approach?
- 3 Repeat the exercise in question 1 using the nine-stage process for creative problem solving. What differences do you notice?
- 4 The formal problem solving process seems to be too simplistic a view of what actually takes place in reality. Can you account for this? Explain.
- 5 How can managers improve their improvisational creativity to deal with the unexpected?
Write about a problem that illustrates the points regarding where the problem solving process often appears to fall down.
- 6 Suggest how improvisation may be used to advantage in implementing business strategies.
- 7 Why should a debate over proposed solutions to a problem be a source of difficulty?

CASES

Pink skirts

A manufacturer has had to stop production of skirts because there is no place to store them. The problem is caused primarily by the fact that there is a large stock of unsold pink skirts that have been in the warehouse for a considerable amount of time taking up costly space. The firm has considered finding extra premises for storage but this does not really solve the problem. The pink skirts – 350,000 of them – cost around £5 each to produce. This means that not only is the firm having critical storage problems but it has around £1.75 million tied up in stock. The problem is so acute that immediate remedying of the situation is essential.

Question

What action should the firm take?

Ideas wanted

Large companies may tighten payment terms and order small suppliers to give a rebate from the value of invoices when business is generally not buoyant. This can create hard feelings and create bad press. Can you think up alternative ways of dealing with hard times that large companies can adopt to avoid having to act in this way?

Ideas wanted

How might town centres develop ‘personalities’ of their own to attract shoppers away from retail parks and large purpose-built, out-of-town shopping centres?

Ideas wanted

It is well known in some circles that small children often enjoy playing with the boxes that toys and games are packaged in just as much as with the toys themselves. Suggest ways in which manufacturers might capitalize on this.

Ideas wanted

Luxury brands and high street chains are investing in e-commerce and are building a presence on sites such as Twitter, Pinterest, Tumblr and Facebook. A number of large well-known retailers are also doing this. Suggest ways in which small businesses might make good use of the Internet to build up their businesses.

Ideas wanted

It is believed by many that if staff believed their ideas for improving their businesses were properly considered by management, this would have a substantial positive effect on the growth of a country's economy. Suggest how businesses might set about engaging better with their workers to bring this about.

Ideas wanted

It is thought that 75 per cent of families throw away the equivalent of a meal every five days by preparing too much. Suggest ways of dealing with this problem.

Ideas wanted

A new report from IKEA has figures showing that more than half-a-million UK homes have three generations living under one roof, a substantial rise in just five years. Suggest what ramifications this might have for business and society in general.

Ideas wanted

Patients often find out-patient clinics difficult to navigate. Passing through the system, they may see different members of staff in a number of locations. This leaves some people isolated or confused, contributing to a poor patient experience. Suggest ways of dealing with these issues.

Assignment

Use one of the approaches suggested in the chapter to come up with possible ideas.

The office

Costs in the office were getting out of control and the company appointed a new office manager to identify and sort out the problems. Her task was to put together a report for senior management outlining how she thought the office could be made a more cost-effective unit. The company had recently equipped the office with a network of computers to facilitate more efficient operations but software problems and difficulties in transferring information from the old to the new system had been a regular occurrence.

The new office manager asked for a breakdown of costs involved in running the office and identified that most of the costs in the department were attributable to staff salaries. Over the past five years there had been an upward trend in the total salaries bill brought about by more junior full-time members of staff receiving incremental payments as they moved up the salary scale. Several members of staff were near retirement age and it occurred to the office manager that if these staff were to take early retirement, then more junior replacements might be found and this in turn could have a substantial impact on the salaries bill and hence on the costs of running the office.

The volume of work passing through the office showed evidence of building up substantially over the past couple of years and it was anticipated that this would increase well into the foreseeable future. The company was expanding its sales and the knowledge possessed by the office was considered an asset to the company in performing good customer relationship management.

People in the office worked a 35-hour week and the company prided itself on being able to offer a family friendly employment contract to all its employees where this was required and operated a company-wide policy of ensuring that staff could have flexible working hours. It also employed teleworking and hot-desking as mechanisms for employing part-time and specialist staff who worked very short numbers of hours.

Question

What do you think the new office manager could have done to tackle the problems that exist?

FURTHER READING

- Byrne, C. L., Mumford, M. D., Barrett J. D. and W. B. Vessey, (2009) Examining the leaders of creative efforts: what do they do, and what do they think about? *Creativity and Innovation Management*, 18(4).
- Fisher, C. and Amabile, T. (2008) Creativity, improvisation and organisations. In T. Rickards, M. A. Runco and S. Moger (eds) *The Routledge Companion to Creativity*, London: Taylor & Francis.
- Vendelo, M. T. (2009) Improvisation and learning in organizations – an opportunity for future empirical research, *Management Learning*, 40(4): 449–456.

Factors influencing people's ability to undertake ideation

Use of the techniques outlined in this book needs some explanation as to their suitability both for people and problems. Not everyone is likely to feel too comfortable using some of the techniques and there are good reasons for this. In addition, some of the techniques are more suitable for specific types of problems than others. In this chapter we examine some of the main thoughts that address these issues. We look at:

- (a) How an individual's characteristics and modes of thinking and learning may impact on their use of techniques in the creative problem solving process. This is also extended to the group situation.
- (b) Which techniques are most suitable for solving different types of problems.

We note that divergent thinkers are more likely to be able to participate in sessions making use of paradigm stretching and paradigm-breaking techniques, and that convergent thinkers will be less at home in doing so. The chapter makes use of the ideas on Thinking Style put forward by Michael Kirton, Learning Style put forward by David Kolb, and the general theories relating to personality developed by Carl Jung, and further developed and used by Katherine Cook Briggs and Isabel Briggs Myers. We also note that within the context of ill-structured problems there are those that can be approached by using paradigm methods, those that benefit from paradigm-stretching methods and those that benefit from paradigm-breaking approaches. The situation, however, is complex and there are some overlaps in suitability among the approaches. Group dynamics are also important and attention needs to be given to whom to include in group problem-solving techniques since this can have a considerable influence on the outcomes of the interaction that takes place. This chapter sets us up to examine each of the stages in the creative problem solving process that are developed in the following chapters in the light of how individuals might react to the methods explored in them.

WHAT HELPS PEOPLE GET IDEAS

People who are good at intelligence tests have been shown to have large working memories. This does seem to lead to the suggestion that they are also better at coping with complex problem solving and handling the more sophisticated techniques. However, measures of intelligence do not explain creative ability. Efforts have been made to establish the links

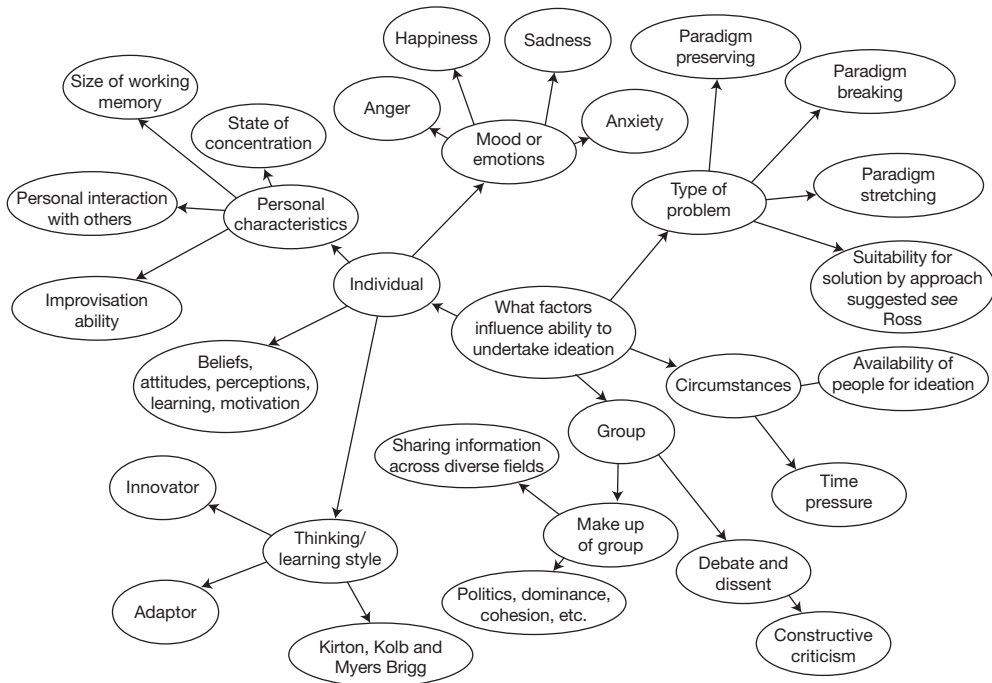


Figure 5.1

The factors influencing people's ability to undertake ideation

between measures of intelligence and highly productive creative thinking, but measures of intelligence themselves are insufficient to explain it. Psychologists reached the conclusion that creativity is not the same as intelligence. A person can be far more creative than he or she is intelligent, or far more intelligent than creative. Highly productive creative thinkers form more novel combinations than the merely talented and they seem to possess the ability to make juxtapositions between dissimilar subjects. It is a facility to see things to which others are blind.

Most people, given data or some problem, can work out the conventional response. Typically, people think reproductively – that is, on the basis of similar problems encountered in the past (see Chapter 3 for the development of this notion). When confronted with problems, we make use of previous experiences and apply a method or approach that has worked before. If there is more than one such approach, we select the most promising and work within a clearly defined direction towards the solution of the problem. This can lead us to become too certain of the correctness of our conclusion and to develop mindsets (see Chapter 2).

Experience indicates that highly productive creative thinking is generated by thinking productively, not reproductively. When confronted with a problem, people thinking in this fashion look at a problem from many perspectives and search for many different ways of solving the problem. They come up with many different ideas, some of which are quite unconventional and often unique.

With productive thinking, the aim is to generate many different approaches. The least obvious must be considered as well as the most likely approaches. It is the willingness to

explore different approaches that is important, even after a promising one is discovered. Reproductive thinking, on the other hand, can produce too rigid thinking. This can produce an inability to solve a problem that resembles past experiences only in some ways. Interpreting such a problem through past experience will, by definition, not be productive. Reproductive thinking produces solutions that we have employed before and not original ones.

It is important to appreciate how highly productive creative thinkers generate so many alternatives and conjectures, and why many of their ideas are so rich and varied. Highly productive creative thinking is often generated by finding a new perspective that no one else has taken. The first step is to restructure a problem in many different ways. The first way one looks at a problem may be too biased by the way in which one usually views matters. Restructuring takes place by looking at a problem from one perspective and then moving on to another perspective and then still another. With each move, understanding deepens and one begins to understand the essence of the problem. In order to find creative solutions, one may have to abandon the initial approach that stems from past experience and reconceptualize the problem. By adopting more than one perspective, highly productive creative thinkers solve existing problems and even identify new ones.

It would be useful to understand the thinking processes that were involved in producing the *Mona Lisa*, as well as the ones that produced the theory of relativity. It would be more than useful to appreciate what characterizes the thinking strategies of people such as Einstein, Edison, Leonardo da Vinci and Mozart. It is possible that highly productive creative thinkers form more novel combinations than merely talented individuals. If one particular style of thought stands out about highly productive creative thinking, it is the ability to make connections or associations between dissimilar subjects. It is a facility to see things to which others are blind. Leonardo da Vinci forced a relationship between the sound of a bell and a stone hitting water, enabling him to make the connection that sound travels in waves. Samuel Morse was trying to work out how to produce a telegraphic signal strong enough to be received coast to coast. One day he saw tied horses being exchanged at a relay station and forced a connection between relay stations for horses and strong signals. The solution involved giving the travelling signal periodic boosts of power. Nickla Tesla forced a connection between the setting sun and a motor that made the AC motor possible by having the motor's magnetic field rotate inside the motor just as the sun (from our perspective) rotates.

The ability to tolerate ambivalence between opposites or two incompatible subjects is thought to characterize highly productive creative thinking. Edison's invention of a practical system of lighting involved combining wiring in parallel circuits with high-resistance filaments in his bulbs, two things that were not considered possible by conventional thinkers at the time. Because Edison could tolerate the ambivalence between two incompatible things, he could see the relationship that led to the breakthrough.

This may result in the belief that some people are creative and others are not. However, in reality it may simply be a sign of blocked thinking which can be thought of as a strategic block (see Chapter 2).

Moreover, growth and survival can be related directly to an organization's ability to undertake innovative management. To accomplish this, the modern organization has a need for creative thinking in its approach to problem solving and decision making. Put simply, creativity in management involves coming up with new perspectives and insights. However,

this may not be as simple as it might seem. As we noted in Chapter 2, an over-emphasis on managerial control can stifle creativity since autonomy and a degree of freedom are critical ingredients of creative thinking. There may also be a tendency to over-analyse ideas to the extent that nothing is ever properly resolved into a satisfactory outcome or decision. However, sometimes executives may experience an inability to come up with insights, or coming up with ideas that cannot be implemented.

THE TECHNIQUES

One of the earliest forms of creative problem solving seems to have been brainstorming (Osborn, 1953). Its origins are somewhat obscure but in modern times it appears to have been used as a means of focusing attention on finding new insights into problems and decisions at business meetings. A lack of structure and focus in such meetings when it came to making decisions and dealing with problems seemed to suggest that an interesting alternative approach that would evoke participant curiosity and interest might produce beneficial results. During the course of the last half century or so many different forms of brainstorming have become popular and the idea of a structured approach to creative problem solving has spawned a large variety of techniques (e.g. Morphological Analysis, Lateral Thinking, Synectics, TRIZ, Rich Pictures Vision Building, and many others). Indeed, one has only to review the plethora of techniques that are discussed today in popular management books and on a growing number of Internet websites to appreciate the breadth and depth of these techniques (see van Gundy 1981, 2005; Higgins, 2005; de Bono 2008; Sternberg, 1999; Koberg and Bagnall, 2002; O'Dell, 2000; Treffinger *et al.*, 2006; Henry, 2006; von Oech, 2008).

In some ways it seems to be an anomaly that approaches to structured creative thinking and problem solving should be labeled 'creative'. Creativity is associated with a freedom from thinking in vertical and logical ways, so putting a structure on to the process seems to be the very antithesis of what the creative process is all about. Thus, to the sceptical mind it might suggest that one should take a closer look at the techniques that are becoming a popular approach to trying to stimulate the creative process.

QUALITIES OF A CREATIVE PERSON

Creativity is a quality that exhibits itself in the way in which people conduct their lives. People who exhibit creative behaviour:

- challenge the status quo
- confront assumptions
- exhibit curiosity
- like to investigate new possibilities
- tend to take the initiative in most matters
- are highly imaginative
- are future-orientated
- tend to think visually
- see possibilities within the seemingly impossible

- are not afraid of taking risks
- are prepared to make mistakes
- are adaptable to different work environments
- are adaptable to changing circumstances
- see relationships between seemingly disconnected elements
- distil unusual ideas down to their underlying principles
- synthesize diverse elements
- are able to spot underlying patterns in events
- are able to cope with paradoxes
- look beyond the first right idea.

As noted earlier by Osborn, arguably people can be taught, encouraged and coached or counselled to be more creative. Four basic creative strengths and skills can be easily taught:

- 1 *Fluency*: the ability to produce numerous ideas (many of which may be fairly similar or have the same kind of theme).
- 2 *Flexibility*: the ability to produce a varied mix of ideas (none or few of which are similar or share the same kind of underlying theme).
- 3 *Elaboration*: the ability to add detail, depth, mixtures of viewpoints or perspectives.
- 4 *Originality*: the uniqueness, novelty, newness, creativeness (new) or innovativeness (improvement of existing).

Fluency can be developed by holding creative thinking sessions at which ideas for a hundred different uses for everyday objects (sponge, toothpick, eraser, brick, paperclip, etc.) should be generated. After reaching this number, move on to work-related objects.

Flexibility can be improved by listing fifty different kinds of uses for everyday objects and then moving on to work on related challenges.

Elaboration can be developed by describing something (hobby, TV show, tree, cat, athletic event, etc.) in considerable detail, using all the physical senses.

Originality can be learned by picking one common object and listing many new uses for it. Regular practice in each of the above activities can lead to the acquisition of improved creative skills.

Creativity skills include:

- Imagination (visual, auditory and kinaesthetic creativity allows you to express ideas and feelings by applying your imagination to produce unique creations).
- Literary (writing a poem, a short story or a play).
- Social (imagining a new way to have a group process go better or improve a programme that provides services to others).
- Innovation (using information from a variety of different sources to create unique solutions to a problem).
- Aesthetics (using a sense of beauty to judge something).
- Visualizing (creating a mental image of an object or idea).
- Designing (creating plans for a new project or product).

- Judgement (using discrimination skills in sound, colour and shape to determine differences).
- Energetic, persistent work-style.
- Orientation towards risk-taking and independence.

However, it has to be considered whether individual differences may be an important consideration when considering people's ability and motivation to learn. Indeed, a person's general style of thinking, their personality and preferred approach to learning may determine their attitudes and behaviour towards creative problem solving. There are a number of important research programmes that have addressed this issue.

Creativity is just connecting things. When you ask creative people how they did something, they feel a little guilty because they didn't really do it – they just saw something. It seems obvious to them after a while. That's because they were able to contact experience they've had and synthesize new things.

Steve Jobs, *Wired*, February 1996

Available at: www.brainyquote.com/quotes/keywords/creativity/html (accessed 28 March 2013).

THINKING STYLE

On the basis of considerable research, Michael Kirton (1976) came to the conclusion that people exhibit two broad creative thinking styles. First there are people who have a preference for taking ideas and improving on them. Such people err on the side of caution, are practical in nature and like to use standard approaches in the way they go about things. They prefer incremental innovation and doing things better rather than seeking to find the very best way of doing things – Kirton referred to such people as Adaptors. By contrast, there are also people who prefer to find new ideas by challenging and changing accepted ways of doing things. These he labelled Innovators. Kirton believes that Adaptors are no less creative than Innovators – it is just that they see and approach things from a different perspective. Kirton emphasizes that Adaptors and Innovators are not two totally different types of individuals. It is simply that people are more adaptive or more innovative. Kirton has devised an inventory to measure where individuals may stand along this continuum. One might reasonably anticipate that Adaptor types are likely to be less enthusiastic about paradigm stretching and paradigm-breaking techniques than Innovative types. However, on this kind of differentiation among people we might find that Adaptor types show some affinity towards techniques that use existing paradigms.

PERSONALITY

The Myers-Briggs Type Indicator (MBTI; Brigg and Myers, 1976; Kroeger and Thueson, 1988; Myers and McCaulley, 1985; Myers and Myers, 1980) is a self-report measure designed to

assess individuals' preference for different types of information processing. Individuals are rated in terms of the following dimensions: introversion, extroversion, intuitive, sensing, thinking, feeling, perceiving, judging. In terms of these dimensions, most closely associated with creativity are: introversion, intuitive, thinking, perceiving (Houtz *et al.*, 1981, 1994, 2003). Building on this, investigations into the relevance of Jung's theory of individuals' preferences (e.g. Lawrence, 1982,; Myers and McCaulley, 1985) suggest a number of implications.

Introverted personalities need time to think and clarify their ideas, while extraverts are happy to talk over their thoughts with others in order to clarify them. Moreover, introverts focus on their own understanding of concepts and ideas, while extraverts are more concerned about the viability of their ideas in practice. Sensing individuals focus on facts, details and reality, showing a preference for solutions that have worked in the past. Intuitive types concern themselves with the meaning of facts, how they are interrelated and what the implications of all this are. They have a preference for developing new, original solutions rather than using what has worked previously. Individuals with a 'thinking' preference try to use logic and analysis during problem solving. They also value objectivity and like to be impersonal in drawing conclusions. Such people expect solutions to make sense in terms of the facts, models, and/or principles under consideration. On the other hand, people with a 'feeling' preference rely on their values and feelings. The latter tend to be subjective in their approach and concerned about how solutions or decisions can impact on other people. In terms of the 'perceiving-judging' dimension, 'judging' types prefer structure and organization and will want the problem solving process to demonstrate closure. 'Perceiving' types prefer flexibility and adaptability and are more concerned that the problem solving process considers a variety of techniques and provides for unforeseen change.

From the creative problem solving perspective, the following seems to be implied for the various types discussed above:

- *Extrovert* – like group brainstorming, thinking aloud, psychodrama, talking through problem in group.
- *Introvert* – like brainstorming privately, incubation, want to reflect.
- *Sensing* – like inductive reasoning, random word technique.
- *Intuitive* – like to classify, categorize, deductive reasoning, challenge assumptions, imagining, visualization, synthesizing.
- *Thinking* – like to classify, categorize, analysis, solutions make sense based on fact.
- *Feeling* – like to share personal values.
- *Judging* – like to follow procedures, Plus Minus Interesting technique, looking for single solutions.
- *Perceiving* – like a variety of alternatives to be considered, brainstorming, random word, outrageous provocation, taking another perspective.

On the whole, most personality types should have a positive attitude to the use of the creativity techniques advocated in books and on the Internet. Perhaps the types who will be least happy with the experience will be 'judging', 'introverts' and 'thinking' types.

LEARNING STYLE

Learning styles present another perspective from which to understand how people may approach the process of creative problem solving and approach using the various techniques. Kolb (1976, 1981) developed the Learning Style Inventory to evaluate the way people learn and work with ideas in day-to-day life. Using this framework he identified four different types of preferred learning styles:

- 1 'Divergers' who perceive information concretely, process reflectively, are imaginative, believe in their own experience, are insight thinkers, thrive on harmony and personal involvement, seek commitment, meaning and clarity, and have high interest in people and culture.
- 2 'Assimilators' who respond to information presented in an organized, logical fashion, and benefit if they are given time for reflection. Their characteristic question is 'What?' To be effective, the instructor should function as an expert. Assimilators perceive abstractly, process reflectively, devise theories, seek continuity, need to know what experts think, love ideas and are detail oriented.
- 3 'Convergers' respond to having opportunities to work actively on well-defined tasks and to learn by trial and error in an environment that allows them to fail safely. Their characteristic question is 'How?' They perceive abstractly, process actively, integrate theory and practice, are pragmatic, dislike fuzzy ideas, value strategic thinking, are skill oriented, like to experiment, and seek results and applications.
- 4 'Accommodators' like open-ended questions and to discover things for themselves. Problem-based learning is their ideal situation. They perceive concretely and process actively, learn by trial and error, are interested in self-discovery, are enthusiastic about new things, are adaptable and flexible, like change, are risk takers, and people are important to them.

Divergers and accommodators are likely to be most at home with the creative problem solving techniques. Convergers and assimilators may be less happy with the techniques.

MOOD OR EMOTIONS

Notwithstanding the foregoing, individual moods and emotions can impact on the ability to participate in the creative problem solving process. Both anger and anxiety can have a negative effect on a person's ability to contribute effectively. It is generally considered that being in a happy state of mind is essential. While many of the great poets wrote their most powerful and best remembered poems in a state of sadness, we do not feel that we have any evidence to argue for it.

Beliefs, attitudes, experience, motivation and perceptions have a strong impact on a person's ability to be creative and to successfully participate in the creative process. In defining the problem, perceptions may be strongly influenced by prior beliefs, attitudes, experience or motivation. The person having such perceptions may be totally unaware of this and the bias it brings with it. Attitudes towards participating in the use of the techniques have to be positive. Motivation to find insights into a problem is essential. Moreover, a person's experience will temper whatever ideas arise as a result of any ideation that takes place.

For the individual trying to get insights into a problem there is the danger that over-concentration can block the ability to solve the problem. Moreover, being able to gain a sudden insight into a problem – that is, to improvise – will depend on the individual's ability to recall patterns and use them in a meaningful and systematic way. In addition, interaction with other people and sharing highs can be very productive.

PROBLEMS IN GROUPS

The foregoing indicates that there are potential problems associated with using creative problem solving techniques that are associated with a variety of attributes associated with the individual's psychological make-up. However, since most, if not all of the techniques can be used in a group situation as well as by individuals working on their own, a solution to the foregoing may be found in using the creative problem solving process in a group situation. Arguably, two or more heads are better than one, but experience has shown that getting a group of people to discuss a problem and come up with ideas in an unstructured manner often ends in chaos with no satisfactory outcome. Techniques such as brainstorming were thought up to deal with just such a problem. Other techniques too, as we shall see in the ensuing chapters, are amenable to use by groups of people as well as individuals on their own. Nevertheless, while brainstorming in particular produces ideas and possible solutions, it does not seem to produce very good ones. Indeed, Lehrer (2012) recommends that critical appraisal, debate and differences of views are more likely to produce good results. Constructive criticism and critical thinking can be even more effective. However, one should not overlook group dynamics whatever method of ideation is undertaken in a group situation. Of particular importance is the make-up of the group. If members have worked together many times, they may be too familiar with each other's points of view (Lehrer, 2012). This may then prevent the emergence of good ideas. On the other hand, expecting groups to generate ideas when they are almost unknown to each other can be as equally a bad strategy and produce poor results. What is required is a group that lies somewhere between these two extremes in terms of how familiar they are with each other.

Politics, dominance and collusion can be problematic when working in a group situation. In particular, the major coalition or more senior members may exert undue influence on outcomes. The creative problem solving techniques can be open to manipulation and this is something of which to be very much aware.

One of the key features of group creative problem solving is the sharing of information across diverse fields. Getting outsider views on a problem can often be extremely productive and lead to the solving of what seem quite intractable problems. Indeed, one can take this outside of the arena of using creative problem solving techniques. Innocentive is a website that has been set to get outsiders help solve scientific problems. The website owners recognized that many companies have scientific problems that they struggle to solve but that often lay people may offer valuable suggestions as to where the solution might lie. The website acts as an interface between the two and outsiders who come up with good ideas are suitably rewarded by the firms with the problems (Lehrer, 2012).

The Internet provides a useful service in providing a means of assembling people who otherwise might not be able to work together on a problem. Circumstances can deny the

DANGER OF GROUPTHINK

Janis (1982) argued that groupthink takes place when people working in highly cohesive groups strive for concurrence to such an extent that it undermines their ability to seek and use information, and to consider alternative explanations. Such a situation produces complacency, and shared misperceptions prevent the consideration of alternative interpretations of available information.

Signs of groupthink are:

- (a) group members sharing a feeling of invulnerability, which leads to optimism and a willingness to take risks;
- (b) group members being close-minded, collectively rationalizing or discounting aberrant information, and maintaining stereotyped views of threats or rivals;
- (c) group members sticking together in their views and discounting or ignoring dissenting views.

These things lead to perceptions of invulnerability and solidarity. Decision making becomes defective as information received that runs contrary to the group's beliefs is dismissed as irrelevant or wrong.

availability of people for ideation. Since it is argued that the make-up of a group is important, it may be difficult or impossible to get together a group with the desired characteristics.

THE RANGE OF TECHNIQUES AND THEIR SUITABILITY FOR SOLVING DIFFERENT TYPES OF PROBLEM

The availability of such a plethora of techniques tends to lead to a confusion in people's minds about which techniques are suitable for which problems (Ross, 2006). McFadzean (1998a, 1998b, 1998c) offers a plausible approach based on different degrees of paradigm shift required to solve a problem. Taking the notions of paradigm preserving, paradigm stretching and paradigm breaking, she classifies techniques according to how well they fit in with this classification.

Paradigm-preserving techniques include such things as classical brainstorming, morphological analysis and listing, and also many of the straightforward techniques not requiring analogical reasoning. This category might include such things as obtaining ideas on how to improve products or services by listing their features or dimensions and thinking of alternative ways in which these might be provided.

Paradigm-stretching techniques largely require some degree of analogical reasoning and include such things as synectics and the use of metaphors. In this case, one might identify features and dimensions of an analogous problem for which solutions are known and then relate these back to the given problem in order to gain appropriate insights. One might argue that it is a preferred approach if the paradigm-preserving mechanisms fail to yield any useful insights. These two classifications identified by McFadzean seem to be appropriate since the use of

metaphors and analogical reasoning takes one away from viewing problems in their customary context and facilitates the stretching of existing paradigms into new domains. Despite the comments above, it is less clear when one specific technique is to be preferred to another, or even perhaps when one needs to undertake paradigm stretching as opposed to working within an existing paradigm other than in the case of the pragmatic considerations noted above.

Paradigm-breaking techniques lead to gaining brand-new insights into problems. The invention of the jet engine, discovery of the benzene ring, creation of the Internet, television and even radio, all led to radically new ways of understanding or facilitating human activities. While none of these things may have been facilitated by the paradigm-breaking techniques of vision building, wishful thinking, rich pictures or role playing envisaged, such aids can help participants to develop fantasies that may help them to generate novel ideas. While the use of synectics was discussed in the last section, it is possible that the 'fantasy analogy' mechanism employed in one variation of synectics could lead to paradigm shifts. Two of the techniques involve working with visual images (visualization and rich pictures). Clues may be presented in the form of pictures and these are remembered more easily than words (Berry *et al.*, 1997) and allow access to semantic memory more easily than words. There is plenty of empirical support for the notion that images are associated with creative thought (LeBoutillier and Marks, 2003). Do and Gross (1995) describe how in the course of creative and conceptual designing, architects often look to books, magazines and other collections of images to find forms they can adopt and adapt in designs. They argue that a more direct visual, graphical reminding scheme based on sketches can help designers recall interesting references from various domains. Their paper describes 'Drawing Analogies', a shape-based reminding program that uses hand-drawn sketches to index and query visual databases. Given this kind of evidence, it is logical to explore pictures as clues for solving problems requiring insights (Schwert, 2007).

In summary, while the classification system makes sense and covers the idea of managing the use of paradigms, it is not altogether clear when one technique is more appropriate than another, and there is certainly no guarantee that using the techniques alone will lead to new insights. Other influences are involved and these are notably to do with the people seeking to use the techniques.

CONCLUSION

The use of creative problem solving ideation tools seems to be full of crevices to trap and stymie the individuals whose curiosity has been raised to indulge in the use of such tools. For example, one should not overlook the point made in Chapter 3 that when using analogical thinking, retrieval of suitable analogies from long-term memory may itself produce unsuitable analogies while missing altogether those that would be highly relevant.

In reviewing the comments made in this chapter the reader should view them as constructive thoughts upon which to consider using the tools rather than as reasons for dismissing them from consideration. There are people who are very good at getting ideas and who may not benefit greatly from using creative problem solving tools. Highly divergent thinkers may be able to come up with ideas apparently without any structured thinking at all. After all, the great inventions made by individuals working alone in the past were produced in such a fashion.

Nevertheless, others may not have such propensities and a structured framework for ideation may be helpful. Certainly, group problem solving seems to offer a potential way of overcoming the weaknesses of the individual. In a group situation there is scope to use divergent thinkers and convergent thinkers alike. However, the make-up and atmosphere within the group may be critical to its success in gaining insights using these techniques and it could be that constructive critical thinking about the problem in hand is a more effective mechanism. As to the fitness for purpose of the techniques in terms of dealing with specific problems then this is still something which merits further investigation and a worthwhile topic for research.

Despite the possible limitations that may be encountered in using any of the techniques, like most management decision-support techniques those related to creative problem solving provide a structuring framework within which to examine problems and facilitate group interaction to explore matters relating to important problems. In addition, they can often provide new perspectives on problems, although the ultimate manner in which the problems are resolved may require further refinements before they can be implemented. Indeed, we must remember that creative problem solving techniques can at best only provide insights into problems or suggested solutions. Putting ideas into practice can only be achieved if they are practically feasible and supported by those who will have to implement them or even finance their implementation. Creative problem solving is only part of the process of the management of change and needs to be appreciated within its broader context.

QUESTIONS

- 1 How do an individuals' characteristics influence his or her ability to undertake ideation (a) without the use of creative problem solving tools; (b) with the aid of using creative problem solving tools?
- 2 Explain the relationship between different types of problems and the suitability of different kinds of creative problem solving tools that may be applied to them.
- 3 How might the circumstances under which people attempt to generate ideas influence their likely success in coming up with ideas? How might this vary according to whether or not they make use of creative problem solving tools that are suited to the problems in hand?
- 4 Discuss how thinking and learning styles may influence how people may interact with creative problem solving techniques. How may this be influenced by whether or not they are working on their own or as part of a group?
- 5 Constructive criticism is a much better way to get new perspectives on a problem than using creative problem solving tools. Discuss.
- 6 How do beliefs, attitudes, perception, learning and motivation influence the ability to come up with new ideas with or without the use of creative problem solving tools?
- 7 What steps can an organization take to minimize the occurrence of 'groupthink'?

CASES

The think-tank

Bolden Pharmaceutical, employing over 2,000 workers of all grades, welcomed its new Chief Executive, Tim Hodges. Hodges had spent years working for petroleum companies anxiously exploring new avenues to extend their product-market scope. Hodges felt that Bolden needed the same kind of treatment and that in addition to looking for new product-market opportunities it needed to review its current operations and look for increased efficiency and savings that would help to cover the cost of new ventures.

As a first step Tim decided to set up a think-tank. The works was located close to open moorland on the Yorkshire–Lancashire border close to one of the many small towns that nestle in the valley bottoms. As part of the complex, but at a distance of roughly 400 yards from the main works, the firm owned an old house – at one time a rectory – which possessed fair-sized gardens and an open aspect over the nearby moors. Tim thought that the building would provide an admirable place to locate the think-tank.

The building was quickly refurbished to provide ample accommodation for a think-tank team. The building allowed for the creation of a well-fitted out conference room with overhead projector facilities, flip charts and an on-line desktop computer. In an open-plan office, created by knocking down the wall between two adjacent first-floor rooms, there was desk space for four people. A telephone, which could take both internal and external calls, was placed on each desk, along with an up-to-date PC and the basic office-type software which goes with such equipment. Tim Hodges also agreed to finance any additional special-purpose software that the team might require – up to a cost not exceeding £10,000 per annum. Secretarial support was provided by two part-time secretaries who between them covered the week 9–5 each day, Monday to Friday.

Four members of the middle-management staff were seconded to the think-tank for a twelve-month period initially. It was agreed that at the end of this period the situation would be reviewed and anyone wishing to return to their previous job would be able to do so. Temporary appointments were made to cover the work of the seconded executives during the year-long trial period. It was made clear that the seconded executives would not be available for their usual duties during this period but that they could be consulted from time to time by the temporary staff covering their work.

The team of four who made up the think-tank comprised one person with a background in the marketing operations of the company, one person from the finance and accounting area, one person from the R&D/operations area and a member of the personnel team. The job of coordinating the team was to be rotated on a three-monthly basis, with each person taking his or her turn at the helm.

The team were given no specific instructions as to how they should proceed with the task they had been given. Tim Hodges made it clear, however, through an internal memorandum to all members of staff – workers and managers – that the team would expect to receive full cooperation from staff at all levels in the organization and that requests for help or information should be treated in the same way as if he himself had requested it.

Questions

- 1 What kind of hindrances do you think the team would be likely to encounter?
 - 2 Given that think-tanks were at one time discarded as an outmoded way of thinking up new ideas, do you think that the team has any real chance of success? Explain.
-

An innovative firm

J. J. Smith is a financial services business. It has decided that in order to step up its innovation activity, the company will have to change its work environment. The traditional office layout is not conducive to encouraging collaboration and exchange of ideas – two aspects that are fundamental building blocks for successful innovation. The company has decided to change the design of the workspace so that ‘bumping into each other’ and working together happens naturally. One suggestion has been that the physical work environment might be transformed into something like an indoor theme park with cobblestone look-alike carpet, town square clock, café and restaurant. No decision has been taken as yet and the company is keen to consider other ideas, too.

A consultant has been hired to help come up with ideas. The consultant expects to make use of one or more creative problem solving techniques using staff from the company to help generate ideas that the firm might like to consider.

Questions

What kind of problems do you think the consultant is likely to encounter in doing this? How might the consultant tackle such problems?

Can you come up with ideas that the firm might consider?

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Objective finding, fact finding and problem finding/definition

Creating more problems

The town council was keen to tackle the problem of lack of parking spaces in an effort to encourage more shoppers to come to the town to take advantage of new shopping facilities that had been developed. These included a large supermarket, which provided limited car parking facilities, and a small mall which also had limited parking facilities. The town possessed three other very small car parks. It was generally agreed that the car park facilities in the town were very limited and the possibility of allowing land to be developed for multi-storey car parking was not an option. The town had two one-way systems at its heart and was recognized as a bottleneck for traffic plying north–south and east–west. A by-pass to the town had been shelved many times and it still remained the only route between several large conurbations in the region. In a bid to solve the car parking problem the council decided to permit limited on-street parking along the main route from west to east at the point where the one-way system became a two-way system. While this action produced an extra two dozen parking places in the town, it exacerbated the bottleneck problem making it difficult for vehicles to pass one another and adding to the traffic congestion problem at rush-hour times. Moreover, when subsequently it was discovered that the town's water mains required substantial maintenance work and that this involved digging up large sections of the road in the vicinity of the on-street parking sections, it brought the whole town to a virtual standstill. The above experience raises the issue of clearly identifying objectives and defining a problem before embarking on solutions that, while solving one problem, may create even more irksome problems.

Establishing and defining the problem is probably the most important stage of the creative problem solving process, for unless the problem is correctly defined it is unlikely that a truly satisfactory solution to it can be found. The objective finding stage essentially involves 'divergent thinking to generate a list of problems one is facing'. Convergence is then used to identify the most relevant problem areas for further exploration. 'Hits' and 'hotspots' are identified by questioning 'ownership' (is one motivated to solve it); priority (how important is the problem);

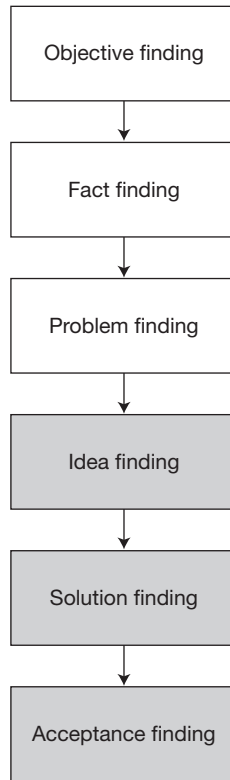


Figure 6.1
Position of the chapter within the CPS process

and critical nature (how urgent is it to solve this problem). Next is the fact-finding stage, where overall comprehension of the problem is increased by collection of relevant information. This also helps new ideas to be generated. ‘Hits’ and ‘hotspots’ can assist convergence here. The previously identified problem(s) may now be seen from a new perspective. There are a variety of problem definition mechanisms. They can be considered as either redefinition approaches or analytical approaches. First we look at redefinition approaches. The techniques we consider here include laddering, goal orientation, boundary examination, progressive abstractions and the ‘why’ method. Under the heading of analytical methods we look at decomposable matrices and cause and effect diagrams. In the next five chapters we will look at different approaches to ideation that can be used.

Stressing the importance of objective finding, fact finding and gaining different perspectives on a problem can itself sometimes alleviate blocked thinking. The problem we start off with is not necessarily the one that we should try to solve. It is quite possible that if we try to solve the problem as we initially perceive it, then either it won’t be solved to our satisfaction or the solution we implement will only provide temporary relief to the problem. Quite often we are apt to treat symptoms rather than getting to grips with the real problem itself.

OBJECTIVE FINDING

Constant environmental analysis and problem recognition

Executives and managers have to be constantly on the lookout for problems and might be able to identify them in one of a number of ways:

- 1 By comparing current experiences with past experiences.
- 2 By comparing current experiences with current objectives or plans.
- 3 By comparing performance with models of desirable outcomes.
- 4 By comparing performance with that of other organizations or sub-units.

(Pounds, 1969)

Pounds noted that the most commonly used approach was the first and that the third and fourth were rarely used. Some business problems require extensive study because they seem likely to uncover the possibility of producing profitable marketing opportunities or, conversely, sizeable losses. Some will require immediate attention while others may be less urgent.

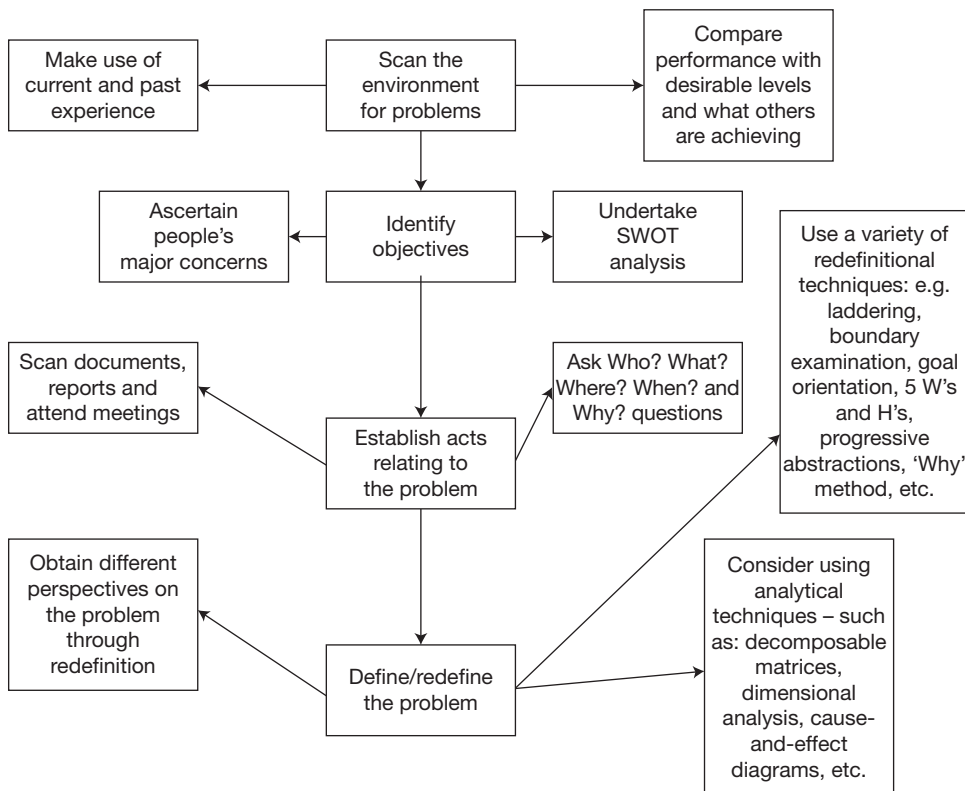


Figure 6.2

Overview of objective finding and problem finding/definition

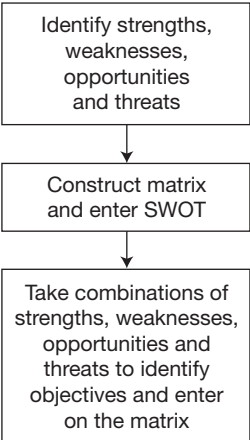


Figure 6.3
Objective finding

One possible approach involves using SWOT analysis. One first identifies various strengths, weaknesses, opportunities and threats. One then looks at various combinations of strengths–opportunities, strengths–threats, weaknesses–opportunities and weaknesses–threats to identify potential objectives.

In Figure 6.4 a toy manufacturer is reviewing its marketing position and strategies. A more general approach to objective finding involves asking the group to defer judgement and list some major concerns in the company or business.

	Strengths (S)	Weaknesses (W)
	1 Strong existing contacts with outlets 2 Well established company name and image	1 High production costs 2 Seasonal sales
Opportunities (O) 1 Film spin-offs 2 Holidays approaching	How to win major toy contracts using outlets and company name (O1, S1, S2)	How to advertise products so that they will sell all the year round (O2, W2)
Threats (T) 1 Competition from abroad 2 Kids now want electronic gizmos	How to use the company name to develop electronic toys to appeal to 'techno' kids (T2, S2)	How to reduce costs to compete with threats from foreign competition (W1, T1)

Figure 6.4
A toy manufacturer reviews its marketing position and strategies

Next one identifies 'hits'. This is a subjective process and varies from company to company and from person to person. Clusters of hits can be grouped into hotspots and more generic or succinct objectives formulated. To do this they use the criteria of ownership, priority and critical nature. After reviewing the hits and applying the criteria, decide on the problem statement. One is then ready to move on to the next stage – fact finding.

FACT FINDING AND PROBLEM DEFINITION/REDEFINITION

Six honest serving men

The six honest serving men method (Parnes *et al.*, 1977) is perhaps most useful in the fact-finding stage, although it can be applied usefully at other stages. The technique involves asking such questions as:

- Who will be . . . ?
- What will they . . . ?
- Where will they . . . ?
- When should it be . . . ?
- How will they. . . ?
- Why will they. . . ?

The steps are as follows:

- 1 State the problem in the format . . . In what ways might . . . ? (IWWM . . . ?).
- 2 Write down separate list of Who? What? Where? When? Why? and How? questions relevant to the problem.

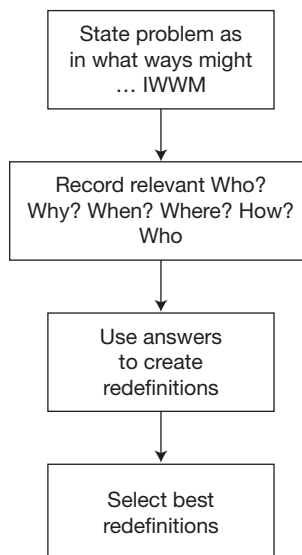


Figure 6.5

Fact finding

- 3 Examine responses to each question and use as a stimulus to generate problem redefinitions.
- 4 Record problem redefinitions generated in (3) above.
- 5 Select the best redefinition for ideation purposes.

Much of this kind of information can be obtained from scanning documents and reports and attending meetings. In addition, many of those involved in problem solving will have this information in their heads. It is necessary to get the information out into the open.

Example

The problem concerns low staff morale in a supermarket chain.

- 1 IWWM we improve staff morale?
- 2
 - *Who are the people concerned?*
Shop service counter staff.
 - *What is low morale?*
Lack of motivation to do a good job and present a friendly interface with the customer.
 - *Where does the problem seem to persist?*
In all city centre locations.
 - *When is the problem most in evidence?*
At weekends.
 - *Why should one try to raise morale?*
To improve the customer-service interface and encourage more customers to shop at weekends.
 - *How can morale be heightened?*
By finding out how best to satisfy the wants and needs of staff.

The foregoing might produce the following problem redefinitions:

- IWWM we satisfy the wants and needs of weekend retail counter staff in city centre stores?
- IWWM we seek to improve the friendliness of the customer service interface?

DIMENSIONAL ANALYSIS

This is a useful method for producing a checklist for use during pre-problem solving (Jensen, 1978). It also acts as a general guide for prefacing the use of some other analytic method. Defining the limits or boundaries and dimensions of a problem are important. The method examined here considers a problem from five different dimensions: substantive, spatial, temporal, quantitative and qualitative. The following steps should be followed:

- 1 State the problem.
- 2 Write down separate descriptions of the problem in terms of What? Where? When? How much? How serious?
- 3 Answer questions relating to each of the five dimensions.

- 4 Assess the answers provided in terms of their significance for solving the problem.
- 5 Select those areas most pertinent to the problem for further analysis.

Example

- 1 Shop-floor productivity is declining.
- 2 – *What aspects of shop-floor productivity in particular are declining?*
 – *Where is the decline in productivity occurring (most)?*
 – *When is the productivity declining (most)?*
 – *How much decline in productivity is involved?*
 – *How serious is the decline in productivity?*
- 3 (a) *Substantive*
 - (i) Commission/omission – does something need to be done, stopped or modified?
 - (ii) Attitude or deed – is the decline due to attitudes or observable behaviour?
 - (iii) Ends or means – is it a cause or an effect? Is it a symptom of an underlying problem?
 - (iv) Active or threatening – is it threatening or just irritating?
 - (v) Visible or invisible – is the real problem apparent?
- 3 (b) *Spatial*
 - (i) Local/distant – is it limited to a specific location?
 - (ii) Isolated or widespread – how extensive is it?
- 3 (c) *Temporal*
 - (i) Long-standing or recent – how long has the problem existed? If solved will it lead to more problems?
 - (ii) Future implications – can it develop into something more serious?
 - (iii) Persistent nature – is there a pattern in its incidence of occurrence?
- 3 (d) *Quantitative*
 - (i) Single or multiple – are the causes one or many?
 - (ii) Many or few people – how many people are involved?
 - (iii) General or specific – does it apply generally or only to certain subgroups?
 - (iv) Simple or complex – does it comprise only a single element or is it made up of many interlocking elements?
 - (v) Affluence or scarcity – is it due to a scarcity of something?
- (e) *Qualitative*
 - (i) Deep-rooted or surface problem – is the problem deep-rooted?
 - (ii) Survival or enrichment – is it a matter of survival or does it merely bring into question the quality of a situation?
 - (iii) Primary or secondary – is it perceived to be of primary importance?
 - (iv) What values are being violated – what is wrong?
 - (v) To what degree are values being violated – is it serious or trivial?
 - (vi) Proper or improper values – should the values be honoured?

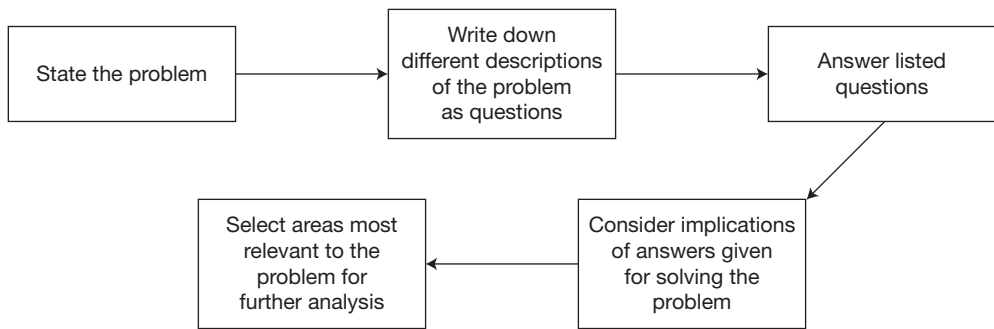


Figure 6.6

Dimensional analysis

Problem finding/definition

The problem-finding stage encourages one to consider a variety of problem perspectives. Restating the problem might unlock a new viewpoint that can lead to many creative solutions. To create these viewpoints, the group examines the information obtained during fact finding to generate possible problem redefinitions. A systematic approach to problem definition can help and direct staff in their efforts to obtain relevant information. In addition, it is also informative to all those people in the organization who will be affected by the findings and recommendations.

Problem definition must take into account the situation of the company and its ability to take sound action. Poorly thought out decisions can cause major problems, sometimes with

THE DELIVERY COMPANY THAT COULD NOT DELIVER

A private parcel-delivery company had many hundreds of parcels reported missing by angry customers. Most of these parcels turned up within a few days, but none of the delays did much to promote the efficient next-day-delivery image of the company. The firm undertook to appoint one of its senior managers to investigate the matter and to report to the directors of the company on his findings.

After much information gathering the manager reported that there seemed to be too many people working on the sorting of the parcels and that many of them did not seem to know what to do. This, he felt, was producing considerable confusion with the result that some packages were being put on to the wrong vans while others were temporarily stored in corners of the sorting room because staff did not know what to do with them.

- 1 Suggest perspectives on this problem.
- 2 What action do you think might be taken to solve the problem?

See Appendix 2 for the solution.

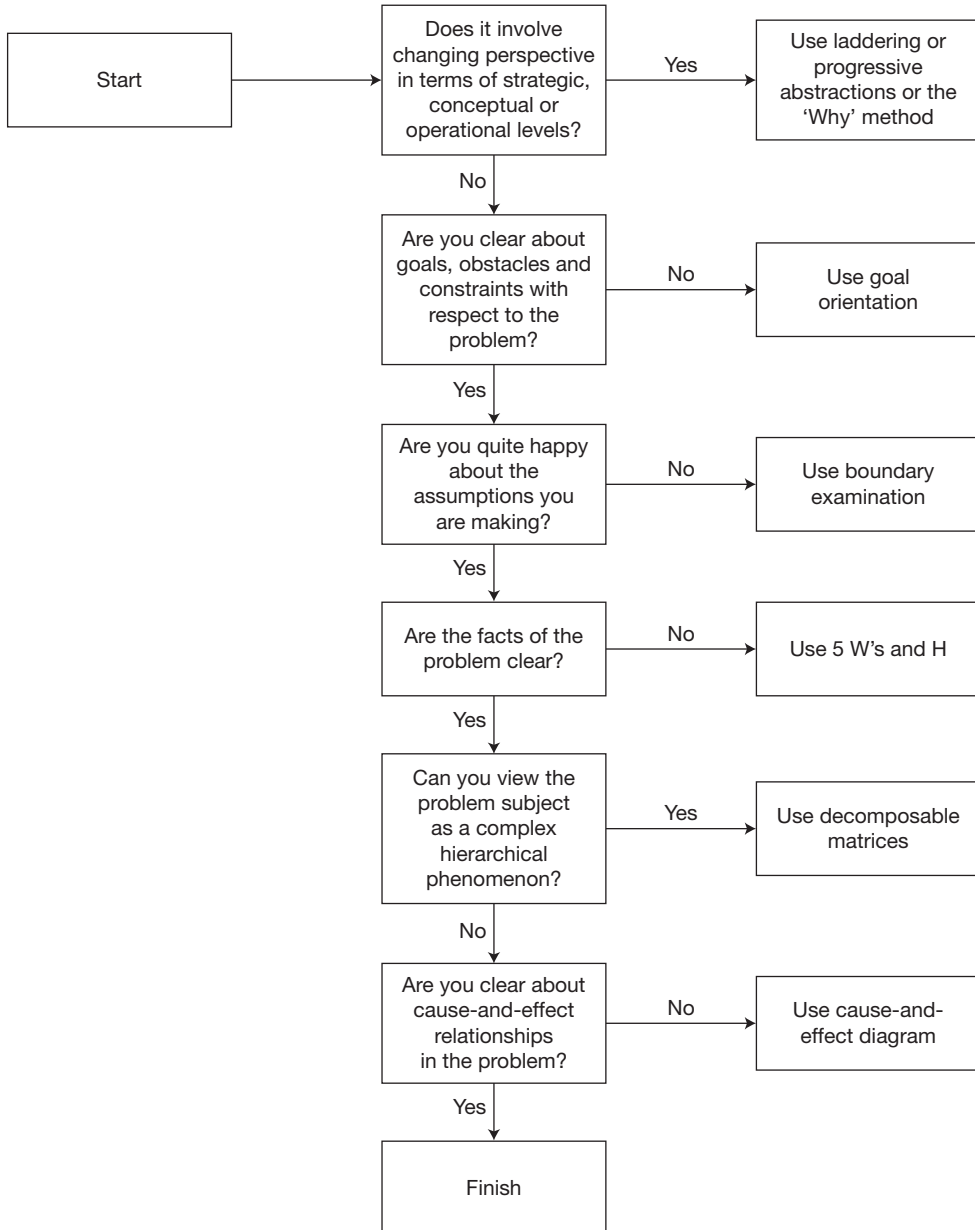


Figure 6.7

Overview of the problem-finding process

SSUEPVEERNMALRETKTEETRS

In the above line cross out seven letters so that the remaining letters, without changing their sequence, will spell out a well-known English word.

Figure 6.8

Defining the problem (see Appendix 2 for the answer)

disastrous consequences. Many things can go wrong, and many opportunities can be missed. The executives in the firm need to anticipate and prevent as many of these as possible, and in each case the first action should be a precise definition of the problem (see Figure 6.8).

Problems arise all the time in business. Some are vitally important problems and concern sales, profits and the general welfare of the business. A well-planned statement of the problem has to be thought through. Since different executives may have different perspectives of the problem, and hence different views as to its precise nature, there is a need to consult everyone concerned before the problem is finally fully specified. Each individual must contribute his or her thoughts to the problem definition before a valid, useful study of the problem can be properly undertaken.

REDEFINITION APPROACHES

A number of methods come under this heading. The main idea behind these approaches is to enable the problem solver to gain new perspectives on the problem.

Getting perspectives on a problem

Two useful approaches to problem definition are suggested by Rickards. The first involves the practising of getting different perspectives, while the second, a technique called 'laddering', provides a useful method for gaining perspectives on actual problems.

Practising perspective getting

Generate a wide variety of scenarios which are readily 'visible in the mind's eye'. Try to make the scenarios ambiguous in nature. Describe the scenario in three or four sentences and then get people to suggest some possible problem perspectives.

Example

- Sam is early for work.
- He is searching his desk.
- The desk is very untidy.
- He repeatedly examines the drawers.

Possible problem perspectives:

- How to find whatever is missing.
- How to tidy the desk.
- How to arrange things in the office so nothing gets mislaid.

An alternative approach, suggested by the author, is to use pictures where the situation is ambiguous and ask people to identify problem perspectives. Have a go at the ones in Figures 6.9–6.13.



Figure 6.9
Problem situation 1



Figure 6.10
Problem situation 2

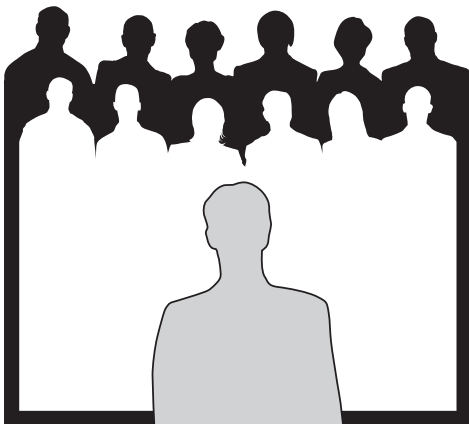


Figure 6.11
Problem situation 3

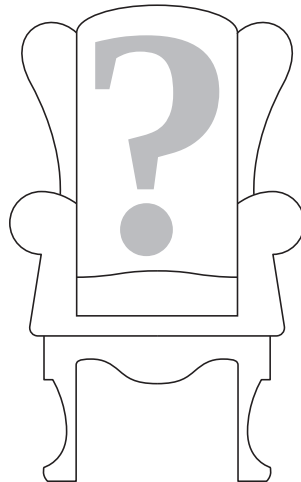


Figure 6.12
Problem situation 4

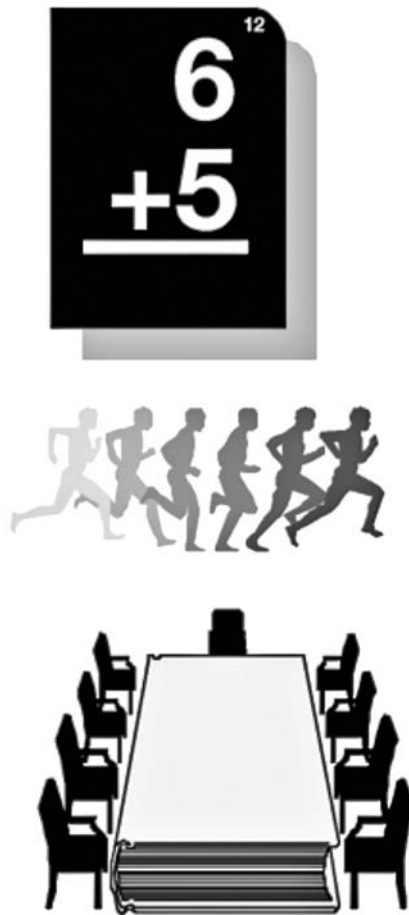


Figure 6.13

Problem situation 5

REDEFINITION APPROACHES: LADDERING

Perspectives can come in varying degrees of complexity. One can think of them as occupying different heights on a ladder. It is often useful to consider where you are on a ladder and whether it would be worthwhile going up to higher levels of generality or down to levels of specifics. The ladder can have many rungs, but we can think of the ladder as having a top portion, a middle portion and a bottom portion. At the top we find the strategic or conceptual level, in the middle we find the operational and managerial level, while at the bottom we find the immediate and fix-it-quick level.

For any situation with which one is familiar it should be possible to find all three levels on the ladder. Asking the question ‘Why?’ moves one up the ladder while asking the question ‘How?’ helps one to move down the ladder.

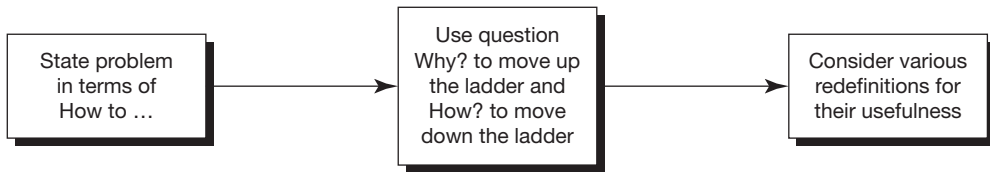


Figure 6.14
Laddering

Example

Consider some perspectives faced by a sales manager trying to expand sales:

- How to improve sales techniques (high level).
- How to provide sales training (middle level).
- How to produce a sales manual (low level).

Laddering is useful for exploring and resetting perceived boundaries of a problem investigation. It helps to avoid too narrow a band of perspectives.

REDEFINITION APPROACHES: GOAL ORIENTATION

Goal orientation is a redefinitional technique that assists us in obtaining a correctly defined problem. It has five stages, the first of which is to work out a general outline of the problem. Suppose that the problem with which we are confronted relates to falling sales experienced

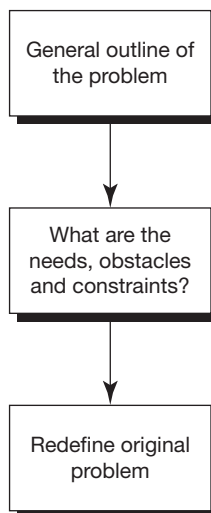


Figure 6.15
Goal orientation

THE PYJAMA COMPANY

A pyjama manufacturer faced resistance from employees to frequent changes to job and work methods that developments in the product and in production methods had forced on them. To tackle this problem the company decided to make use of the creative problem solving process. The stages of the process are: objective finding, fact finding, problem finding, idea finding, solution finding, acceptance finding. Here we shall review how the company set about the first three of these stages.

Objective finding involves stating what the company wanted to achieve. Here the company wanted to overcome the resistance from employees to new methods of operation. The problem concerned employee satisfaction and grievances. The problem of resistance needed to be solved in order to increase the motivation of employees and thence productivity and efficiency.

Fact finding involves stating the facts of the situation. Here output standards had been set for all the jobs in the factory. Each employee's output was calculated daily, and the performance of all workers published in a daily list. The best performers were at the top of the list and the worst performers at the bottom. A bonus was paid according to each person's productivity. High output led to better financial rewards and higher status with management. Most of the employees' grievances related to the fact that as soon as they learned a particular job and started to earn high bonus payments that came with experience they were transferred to another job. Management was thus resented by the workforce since workers were constantly frustrated by their loss of earnings.

Problem finding is concerned with identifying the problem. Many problems seemed to be apparent: lots of complaints about pay rates, absenteeism, high turnover of personnel, low standards of efficiency, marked aggression against management, etc.

Redefining the problem: the boundary-examination technique was used to restructure the assumptions of the problem and produce a new perspective on it. It involved the following steps:

- 1 The problem was initially considered to be 'In what way might the company overcome resistance to new tasks?'
- 2 To overcome this resistance, further ways of rewarding workers in addition to financial incentives needed to be found. This could have resulted in employees being more favourably disposed towards transfers between tasks/jobs.
- 3 The problem was redefined as: 'How might employees be encouraged to be more positive towards the transfers?'

after the entrance of a new competitor into the market. In this case we might accept this as the general statement of the problem. The second step is to work out what the goal is: where the organization wants to be after solving the problem. This might be to regain the previous level of sales. The next steps are to work out what obstacles and constraints the organization must face in order to reach the goal. An obstacle might be that only limited funding is available from within the firm to put an idea into practice. A constraint might be that the existing prices of products need to be maintained since cuts or rises in prices are not considered to be practical considerations for competitive reasons. The final stage is to come up with a new problem statement. This might be:

‘How to get more people to buy our products without reducing or raising prices or being reliant on funds from within the firm’.

Once the problem is correctly defined, we can move on to the next stage of the process – idea finding.

REDEFINITION APPROACHES: BOUNDARY EXAMINATION

Boundary examination (de Bono, [1970] 1971) encourages one to take a fresh look at the assumptions one is making with respect to a problem. Through re-examining the assumptions one can gain a new perspective on a problem. The process is as follows:

- 1 One writes down an initial statement of the problem.
- 2 Important words and phrases in the statement are highlighted and examined for any hidden assumptions.
- 3 Important connotations of assumptions are identified, without considering the relevance of assumptions.
- 4 Any new problem definition that is implied is recorded.

Example

A firm wants to reduce costs of producing and marketing its goods so as to be more competitive in the marketplace.

- 1 In what ways might the company reduce costs of producing and marketing its goods so as to be more competitive in the marketplace?
- 2 In what ways might the company reduce costs of producing and marketing its goods so as to be more competitive in the marketplace?
- 3 (a) company reduce costs – assumes that the firm can reduce costs and it is necessary to do so.
(b) producing and marketing – assumes that the focus of the problem is production and marketing.
(c) more competitive in the marketplace – assumes that the firm is not competitive enough in the marketplace.
- 4 (a) company reduce costs and (b) producing and marketing were taken as the key assumptions. It was felt that the real problem lay not in reducing costs or in more efficient production and marketing but in making the product more attractive to customers. This led to the redefinition: how to make the product more attractive to customers?

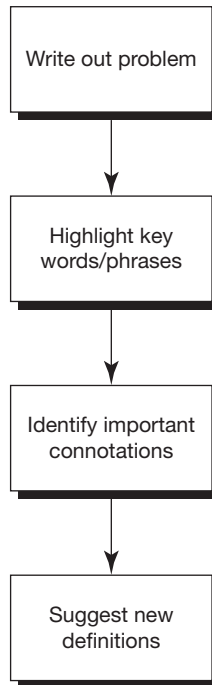


Figure 6.16

Boundary examination

Boundary examination can produce thought-provoking problem definitions. However, there are no clear guidelines for indicating how boundary assumptions should be examined.

EXERCISE

Try to formulate new perspectives on the following problems by using the boundary examination technique:

- A firm wants to get office staff to work weekends to reduce the backlog of unfilled orders, but staff are reluctant to do so.
- A firm is considering relocating its distribution depot to another site and hiring new staff because of the problems caused by wildcat strikes at the present site.
- Absenteeism is creating nursing shortage problems in an NHS Trust hospital.
- Trains on intercity journeys are persistently late in arriving at their destination.
- Demand for holiday travel to a particular destination is falling year by year.

REDEFINITION APPROACHES: PROGRESSIVE ABSTRACTIONS

The method was suggested by Geschka *et al.* (1973) and allows one to make different problem definitions by employing progressively higher levels of problem abstraction until a satisfactory definition of the problem is attained. It is similar to the laddering technique mentioned earlier in the chapter. In essence, it relies on repeatedly trying to identify the essential problem through a series of abstractions from problem redefinitions. The steps are:

- 1 Write down a general statement of the problem.
- 2 Generate possible problem solutions by asking the question: What is the essential problem?
- 3 New problem definitions are developed from the answers produced at (2).
- 4 (2) and (3) are repeated until the solutions begin to exceed existing skills and technological resources and/or until the solutions are outside one's sphere of influence.
- 5 Select a satisfactory problem definition for the purpose of generating ideas.

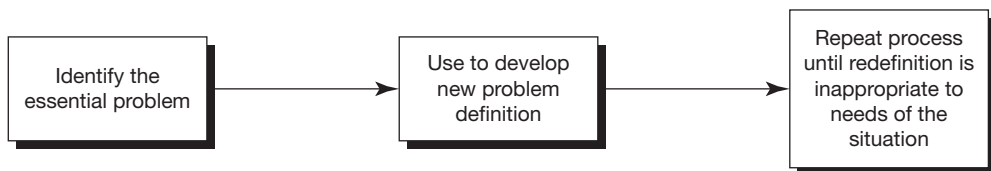


Figure 6.17

Progressive extractions

Example

- 1 How to improve meetings.
- 2 IWWM we improve meetings?
 - (a) have at the most convenient times;
 - (b) circulate agendas well in advance;
 - (c) have better structured meetings.
- 3 IWWM we schedule meetings at the most convenient times for people?
 - (a) use diary facilities on email to find times when people have other recorded commitments;
 - (b) invite only people for whom the meetings are highly relevant.
- 4 IWWM we invite only people for whom the meetings are highly relevant?
 - (a) keep a detailed list of people's interests and update regularly on the network.

The abstractions are continued until either a working solution or a number of solutions can be found or until answers seem to be impractical. In the above example it will be noted that only a part of the possible progressive abstractions have been illustrated. At stage (3), for example, one could ask 'IWWM we have better structured meetings?', and of course there are also other possible progressive abstractions at stage (1) than the one selected for illustration.

REDEFINITION APPROACHES: THE 'WHY' METHOD

This method really reflects the 'why' dimension of the laddering technique mentioned earlier in the chapter. The method again relies on changing the level of abstraction and was suggested by Parnes (1981). As we noted earlier, changing the level of abstraction leads to new perspectives. The method is useful for broadening a problem and exploring its various boundaries. It also helps the user to appraise basic goals and objectives. The steps below should be followed:

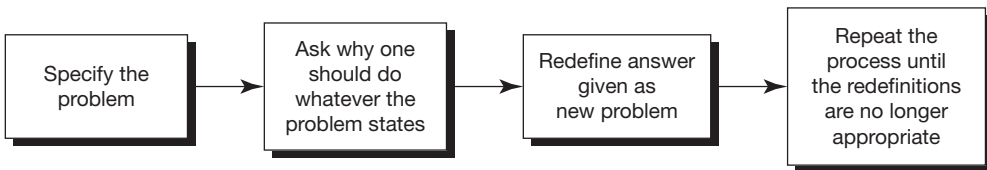


Figure 6.18
The why method

- 1 State the problem.
- 2 Ask why it is that one wants to do whatever is stated in the problem.
- 3 Answer the question posed in step (2).
- 4 Use the answer to redefine a new problem question.
- 5 Repeat stages (2) and (3) until a high level of problem abstraction is achieved.

Example

IWWM we improve the performance of car tyres?

Question: Why do we want to improve the performance of car tyres?

Answer: To improve tyre road-handling under adverse conditions.

Redefinition: IWWM we improve tyre road-handling under adverse conditions?

Question: Why do we want to improve tyre road-handling under adverse conditions?

Answer: To make cars safer to drive.

Redefinition: IWWM we make cars safer to drive?

Question: Why do we want to make cars safer to drive?

At this point we have gone too far with the level of abstraction. We could redefine the problem as: how can we improve the performance of car tyres to make cars safer to drive?

ANALYTICAL TECHNIQUES: DECOMPOSABLE MATRICES

If it is possible to view the subject of a problem as a complex hierarchical system, then this form of analysis can be employed (Simon, 1969). It involves breaking down the system under study into its various subsystems. The method employed is as follows:

- 1 Establish that the subject of the problem can be viewed as a hierarchical set of subsystems – organizations, groups of people, the human body, many different products, production processes, marketing strategies, etc. can be viewed as such systems.
- 2 List the major subsystems and their components.
- 3 Enter the subsystems and their components into a diagonal matrix such that it is possible to identify cells representing the interaction of one subsystem with another.
- 4 Use a five-point scale to represent the importance of the interaction or strength of the relationship between and within the subsystems.
- 5 Select the highest weighted interactions for further analysis or generation of ideas.

Example

Problem: how to improve the design/performance of a motor car.

- 1 Motor car is suitable for this form of analysis – it is a complex hierarchical system comprising a number of subsystems.
- 2 The major subsystems and their components are:

The finished product:

- | | |
|------------------|-----------------------|
| (a) economy | (e) road handling |
| (b) comfort | (f) durability |
| (c) reliability | (g) carrying capacity |
| (d) acceleration | |

Power subsystem:

- (a) engine
- (b) transmission
- (c) fuel
- (d) gearbox

Lubrication subsystem:

- (a) oil and grease material specification
- (b) servicing requirements

Electrical subsystem:

- | | |
|-----------------------|------------------|
| (a) alternator | (f) doors |
| (b) battery | (g) radio |
| (c) ignition system | (h) instruments |
| (d) lighting system | (i) wing mirrors |
| (e) windscreen wipers | |

Chassis subsystem:

- | | |
|----------------|----------------------------------|
| (a) body | (d) interior finish and fittings |
| (b) seats | (e) wheels |
| (c) windscreen | (f) tyres |

Note: all the subsystems form part of the hierarchy but not all the subsystems form part of the same branch of the hierarchy. Finished product, power and lubrication form a branch, for example, but electrical forms part of another branch incorporating finished product and power. It is useful to draw a tree diagram to identify the hierarchies (Figure 6.20).

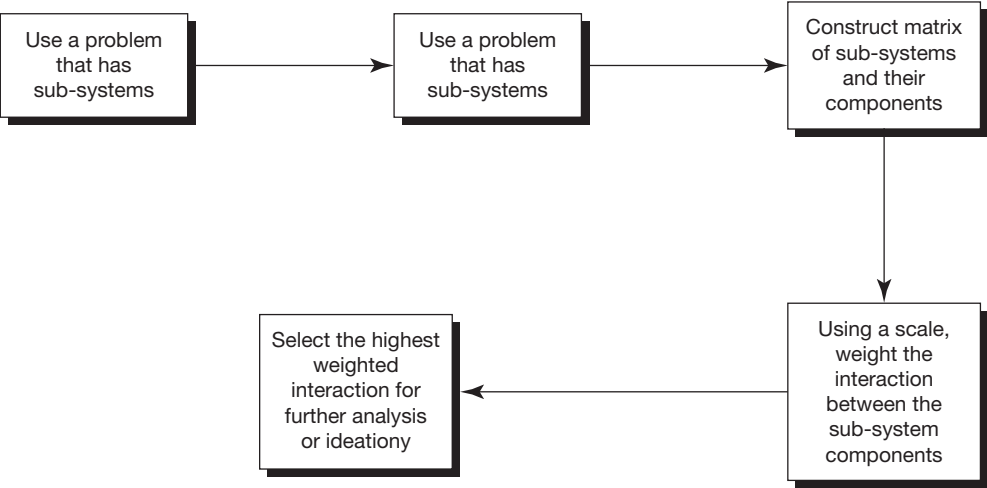


Figure 6.19
Decomposable matrices

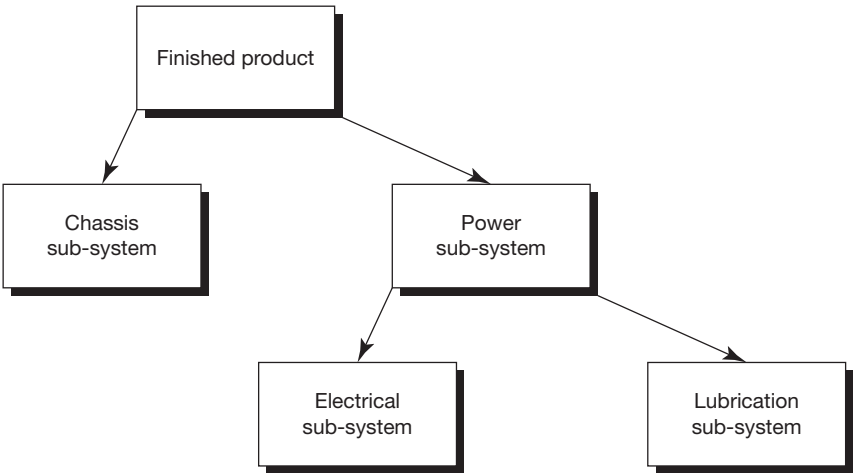


Figure 6.20
Hierarchical subsystems of a motor car

3 Matrix

Here, for reasons of space, we shall consider interactions between the first three subsystems only: finished product, power and lubrication.

Finished product								Power								Lubrication	
F P		a	b	c	d	e	f	g	a	b	c	d	e	f	g	a	b
	a	–	3	2	5	3	1	4	5	4	5	4	1	2	1	4	4
	b	–	–	2	2	4	2	4	3	3	1	1	2	1	2	1	1
	c	–	–	–	1	1	1	1	5	5	2	5	5	5	5	4	5
	d	–	–	–	–	4	1	4	5	5	5	5	2	1	1	3	2
	e	–	–	–	–	–	1	4	3	5	2	2	2	4	4	1	1
	f	–	–	–	–	–	–	1	5	5	5	4	4	5	5	5	5
	g	–	–	–	–	–	–	–	5	3	2	2	2	4	3	1	1
P	a	–	–	–	–	–	–	–	–	5	5	5	3	4	5	5	5
	b	–	–	–	–	–	–	–	–	–	1	5	2	2	5	5	5
	c	–	–	–	–	–	–	–	–	–	–	1	1	1	1	1	1
	d	–	–	–	–	–	–	–	–	–	–	–	1	1	5	5	5
	e	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	1
	f	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	1
	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
L	a	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5
	b	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Notes: FP = finished product

P = power

L = lubrication

Figure 6.21

A decomposable matrix

Where high scores at the interface between subsystems occur, these will be seen as of great interest and key areas for further exploration. For example, gearbox (power subsystem d) and oil and grease material specification (lubrication subsystem a) and servicing requirements (lubrication subsystem b) are picked out as very important.

ANALYTICAL TECHNIQUES: CAUSE-AND-EFFECT DIAGRAMS

The problem first identified here is the high absenteeism rate. We look for causes, effects and associations, and produce a map or diagram (Figure 6.22). The next stage involves picking out those causes and effects that seem to be central to the problem under study. If something is too far removed from the central problem, it is discarded. In Figure 6.22 the boxes relating to orders and repeat sales are peripheral to the central problem and so are discarded. The remaining boxes, however, may be taken either as suitable redefinitions of the original problem or as starting points for further exploration.

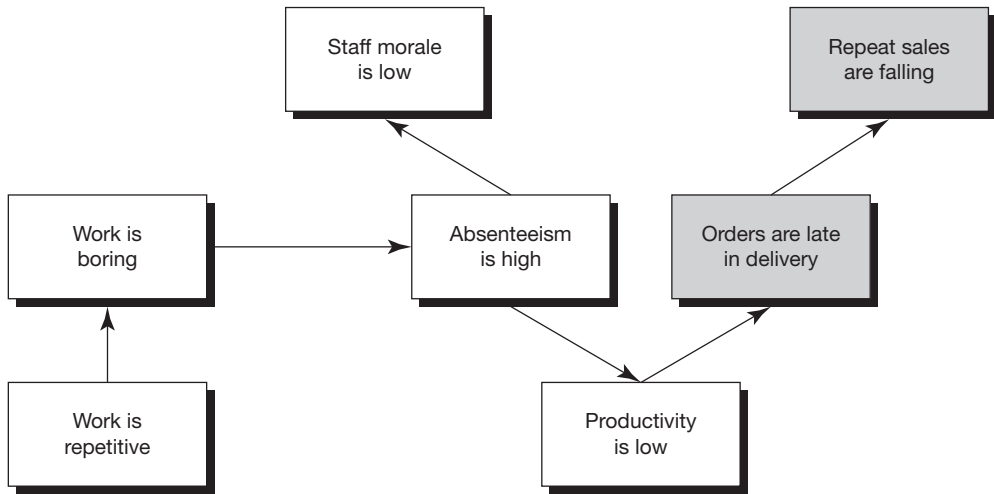


Figure 6.22
Cause-and-effect diagram

A note of caution

While people should be encouraged to understand a problem before generating ideas, if they do this too thoroughly they run the risk of corrupting any potential ideas they may generate. Problem definition is a catch-22 situation, ending in a paradox.

Greater analysis of a problem leads to greater understanding of it. This may produce fresh perspectives but it may inhibit getting unique ideas. Knowing too much can lead to conventional solution proposals.

To overcome this problem Gordon (1961) suggested describing a general, abstract problem without revealing the 'real' problem. This abstract problem should have the general principle underlying the real problem. The participants should then be asked to generate ideas for the abstract problem. The process should then be followed by repeating it for a slightly less abstract, more specific version of the real problem. This process may be repeated again with an even more specific version of the real problem. Finally, the real problem should be revealed and ideas for the two abstract problems used as stimuli for new ideas.

It is suggested here that since the process is a fairly long one it might be reserved for situations where over-analysis and familiarity with the problem are an issue. Moreover, it is an approach that users may find more suitable to use with some creative problem solving techniques than others, e.g. brainstorming.

QUESTIONS

- 1 Why is problem redefinition important? Describe two different mechanisms that can help with the task of defining and redefining problems.
 - 2 'The solution to a problem lies in its definition. 'To what extent would you agree or disagree with this statement? Why?
 - 3 A firm is concerned with improving productivity in the office. Illustrate how two different problem redefinition methods can help bring about new perspectives on such a problem.
 - 4 How can one try to make sure that one has correctly defined a problem?
 - 5 Why is it often desirable to undertake problem redefinition when trying to find solutions for a problem? Take any management problem you consider has many possible solutions and outline two methods that might be used to help redefine the problem.
 - 6 A civil engineering project involves constructing a road through a crocodile-infested swamp. Experience to date shows that the crocodiles present a considerable hazard to human life and threaten the completion of the project within the time schedule. Failure to complete within the scheduled time period will incur penalties of the order of £1 million per day. Suggest different perspectives on the problem using the laddering technique.
 - 7 In order to define a problem it is first necessary to recognize that a problem exists, to identify objectives and establish facts relating to the problem. Illustrate how you would do this with regard to a problem of your choice.
 - 8 Show how dimensional analysis might be used to define the limits, boundaries and dimensions of a problem relating to inroads being made into your markets by competition.
 - 9 Using a management problem of your choice, show how you might use the following methods to help with defining the problem:
 - (a) goal orientation
 - (b) boundary examination
 - (c) progressive abstractions
 - (d) 'why' method
 - 10 Illustrate with a suitable example how you might use decomposable matrices.
 - 11 Consider how you might use cause-and-effect diagrams in dealing with previously unencountered problems. What are the main difficulties you might expect to encounter?
-

CASES

Keeping up with demand

A firm was faced with the problem of keeping up with the demand for its products. It had only limited resources available in terms of workforce and machinery, and demand for its products was far in excess of what it could produce. In order to try to generate some insights into the problem the firm felt that it might be a good idea to try to get a different perspective on the

issues involved. Accordingly, it decided to use the first stages of the creative problem solving process for this purpose. The steps it took are outlined below:

- 1 How to increase production in order to keep up with demand?
- 2–3 What are the factors of production? In what ways can we reduce production times? In what ways can we encourage the workers to work faster? In what ways can we increase the possible capacity of production? In what ways can we speed up the production process?
- 4 Could be redefined as: how can we reduce production times?

The problem has now been redefined as a more precise problem. The focus is now on the production time rather than on just production itself. The problem has been identified and defined in a precise enough way that the next stage can be carried out.

The second stage is that of fact finding. It is during this stage that the overall comprehension of the problem is increased. The idea is to collect all relevant information that may help one to see the problem from a new perspective.

Production times are made up of two main different factors: employee performance and machine performance. These two factors can be broken down again into more factors.

Employee performance is related to experience, time of day, time of week, training, machine using. The more experienced and more trained the employee, the quicker he or she works. At the beginning of the week or day, employee performance is at its lowest; at the end of the day or week, it is at its highest. The quality of the machine the employee uses affects how motivated he or she is. The better the machine, the more motivated the employee.

Machine performance is related to age of the machine, make of the machine and type of machine. The older the machine, the slower it is and the more frequently it breaks down. Some of the machines are of an inferior make to other machines. These machines are also slower and more prone to failure. Different machines are used for different parts of the production line. The more complex the process, the more complex the type of machine, the slower the production rate.

The location of the production plant and its available space are such that expansion of the production line is not possible. However, excess storage space is available for finished goods and raw materials. The factory runs on a daily single 9–5 shift for five days a week.

A new competitor has recently started building a production plant within the local area. The area suffers from a lack of a skilled labour pool, and the competitor will be looking to employ workers from the local area as it has no workers yet. After the fact-finding stage, the information revealed is used at the problem-finding stage. In this, the third stage, this newly revealed information is used to develop the best product or problem definition possible.

At the end of the fact-finding stage, the problem can be redefined as: 'How can we increase the daily production levels?'

Question

Critically evaluate what the firm did. Can you reach different conclusions by using a different approach? Illustrate and explain.

Quillian Pens

Quillian Pens carried out the following SWOT analysis on its products:

Opportunities

- 1 Growth in developing markets
- 2 Growing number of pen collectors
- 3 Increasing interest in high-tech pens
- 4 Small but growing corporate gift market in many countries

Threats

- 1 Increasing competitive activity at lower price points
- 2 Imitation of own products by competitors
- 3 Competitive brands achieving strong consumer identity
- 4 Growth in secondary brands and own brands

Strengths

- 1 High consumer awareness
- 2 Brand names
- 3 Global recognition

Weaknesses

- 1 Too many old products in the range
- 2 Lack of innovative products
- 3 Somewhat 'boring' image
- 4 Insufficient range of pens in the low price category

Question

Identify the problem objectives to which the Quillian company might seek answers.

Catalogue selling

The management team of catalogue sales has problems with filling the increasing amount of orders sent to them and hence are beginning to fail to satisfy all their customers. Clearly, the company wants to find ways of filling orders and hence satisfying customers. Increasing productivity is an obvious area for investigation.

Until now the management team has been making rapid progress. Over the past twelve months sales have risen steadily, and so has net profit. The marketing team has done its job, and the company is awash with fresh orders. However, in the past few weeks the company has found that weather-related delays and overruns in the cost of building new warehouse facilities will preclude the possibility of expanding inventory storage or taking on more staff for at least six months.

Question

Using the first three stages of the creative problem solving process, suggest how the problem may be redefined for the purpose of generating insights into the situation.

Reducing wear and tear

Motorways wear out with use. The wearing-out process is gradual and uneven. At regular intervals resurfacing becomes necessary and this involves costly repair work which can create huge traffic jams in high density use areas.

As a first step to finding ways of reducing the costs, creativity consultants have been called in to gather information relating to the problem and to obtain different perspectives on it so as subsequently to facilitate ideation.

Question

What redefinitions of the problem might they consider?

Production problems

The Ebonite Company produces car batteries. Recently it has been experiencing production problems. The firm operates a standard production line, and the operations manager has for a long time been considering introducing an alternative method of working. However, both bosses and employees appear to be resistant to the new idea. As things stand, the operations manager has noted the following trouble-spots:

- many defective items
- high staff absenteeism
- low productivity
- raw materials and finished inventory levels too high.

Question

Consider the kind of fact-finding activities that the operations manager needs to undertake in order to define the real problem or problems in this instance.

Airport development

A large city has three major airports. One is to the north while the other two are to the east and west of the city respectively. The airport to the west is by far the largest in terms of the traffic that use its facilities. It is also the nearest to the city lying only 6 miles from the city centre. The other airports are further out and lie 15–20 miles away. The airport to the west has virtually reached its maximum capacity and cannot handle additional traffic without the building of another runway. There are already two runways in constant operation and flights leaving along these runways create a huge amount of noise and pollution problems for many thousands of local residents. Plans to build a third runway face a huge amount of opposition

from local residents and they have gained considerable support for this from members of parliament. The new runway can only be built with the agreement of parliament.

The other two airports would be quite happy to have extensions to their facilities built and there would be much less opposition from local residents in both these cases. However, they are not as well connected to the city as the airport in the west, which has its own metro-rail link direct into the city and its suburbs. In addition, airline companies operating through the three airports differ considerably in the amount of flights they are able to mount. Both the northern and southern airports also take a large amount of unscheduled holiday traffic while the western airport takes mostly regular scheduled flights.

One idea is to build a new airport to the east of the city. Suitable land is available and it could be developed with minimal disruption to local residents. Such a project would involve raising an enormous amount of funds and it is unlikely that the amount required would be forthcoming in the short term. Even if funds were to be available, it would take much longer and be much more expensive than simply adding a third runway at the western airport.

There are several large conurbations much further north in the country and all of these boast substantial international airports. The largest of these lies some 200 miles to the north and when the new high-speed rail link between this conurbation and the city to the south is in operation in ten years' time, the journey time is expected to be around one hour. This is little more than the time it takes to get from the airport in the west to the centre of the city at the present time. The airport, which serves the conurbation in the north of the country, is very keen to expand and is looking for backers for its ambitions.

Questions

Can you come up with some ideas that give some perspectives on the problem and how a satisfactory outcome might be achieved?

FURTHER READING

Chand, I. and Runco, M. A. (1993) Problem finding skills as components in the creative process, *Personality and Individual Differences*, 14: 155–162.

Roberto, M. A. (2009) *From Problem-solving to Problem-finding: Great Leaders Know How to Detect Smoke, Not Just Raging Fires*, Pearson Education, 12 October.

Morphological analysis and related techniques

Combining products into a single product offering

Recognizing the needs of people to have both a small highly portable camera and a tape recorder/dictating machine, Olympus introduced the W-10 digital voice recorder. All material, visual and auditory, could be downloaded with ease on to a PC. The equipment represented the state-of-the-art technology in 2003.

Since 2003 there have been advancements in terms of combining similar types of products. Mobile phones, for example, have been combined with Internet browsing capacity and high-resolution camera and video camera facilities. They have even been developed so that it is possible to project images onto a screen from them.

The combination of product ideas such as those indicated above is something that the technique of Morphological Analysis can help to suggest. Other product improvements can be suggested by the use of the other creative problem solving mechanisms illustrated in this chapter. While leading to new ideas and insights they are all *paradigm preserving* techniques.

INTRODUCTION

In this chapter the techniques we look at are essentially systematic structuring mechanisms designed to facilitate the gaining of insights into the problem. A variety of techniques are considered including checklists, listing, morphological analysis, force-fit triggers, the heuristic ideation process and component listing. If the subject of a problem has one or more easily identifiable dimensions, most of these techniques may be useful tools for helping to generate ideas. The techniques examined here are essentially paradigm preserving techniques and do not require the use of analogical thinking. Most people should find these techniques extremely easy to use. While the techniques are essentially structuring mechanisms and at first sight appear to be at variance with the nature of creativity, they do afford the facility to undertake unassisted ideation within the structures that they offer.

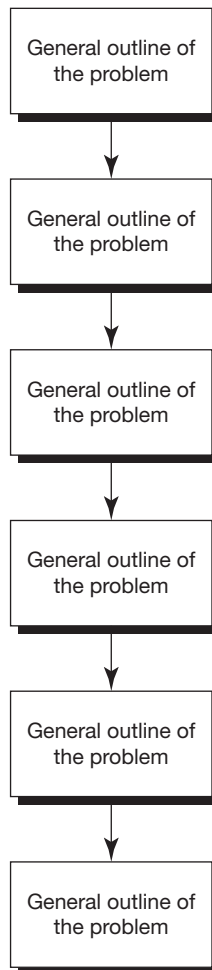


Figure 7.1

Position of this chapter within the CPS process

CHECKLISTS

This is the use of questions as spurs to ideation. The simplest checklist comes from the six basic questions:

- 1 Why is it necessary?
- 2 Where should it be done?
- 3 When should it be done?
- 4 Who should do it?
- 5 What should be done?
- 6 How should it be done?

Example

How to create a friendly atmosphere at work:

Why? To make it easier to communicate with colleagues and get work done.

Where? Especially in meetings where staff of all grades are present.

When? Prior to the meetings taking place.

Who? The departmental manager.

What? Tell all staff how a meeting should be conducted and what is expected of them.

How? A booklet or leaflet circulated to all staff for guidance.

The following questions might also be usefully applied to problems in general:

- Adapt?
- Modify?
- Substitute?
- Magnify/maximize?
- Minimize/eliminate?
- Rearrange?
- Reverse?
- Combine?

Example

A desk.

Adapt? Make it convenient for different sizes of people.

Modify? Make it portable.

Substitute? Make it of metal instead of wood.

Magnify/maximize?: Make the drawer space larger.

Minimize/eliminate?: Get rid of protruding handles.

Rearrange? Rearrange the location of the drawers and integrated trays.

Reverse? Have a detachable/reversible glass/plastic top to the desk.

Combine? Combine with chair into an integrated unit.

The following might also be applied:

- Add/subtract something.
- Change colour.
- Vary materials.
- Rearrange parts.
- Vary shape.
- Change size.
- Modify design or style.

Example

A wrist-watch.

Add/subtract something: Add a compass.

Change colour: Have multicoloured cases.

Vary materials: Make cases out of fibreglass.

Rearrange parts: Have the hours running from 12 to 1 instead of 1 to 12 and make the watch hands move backwards.

Vary shape: Triangular, hexagonal, octagonal, square, round, etc.

Change size: Have many different sizes.

Modify design or style: Have frequent updates on style and have designer-type labels linked to well-known fashion houses.

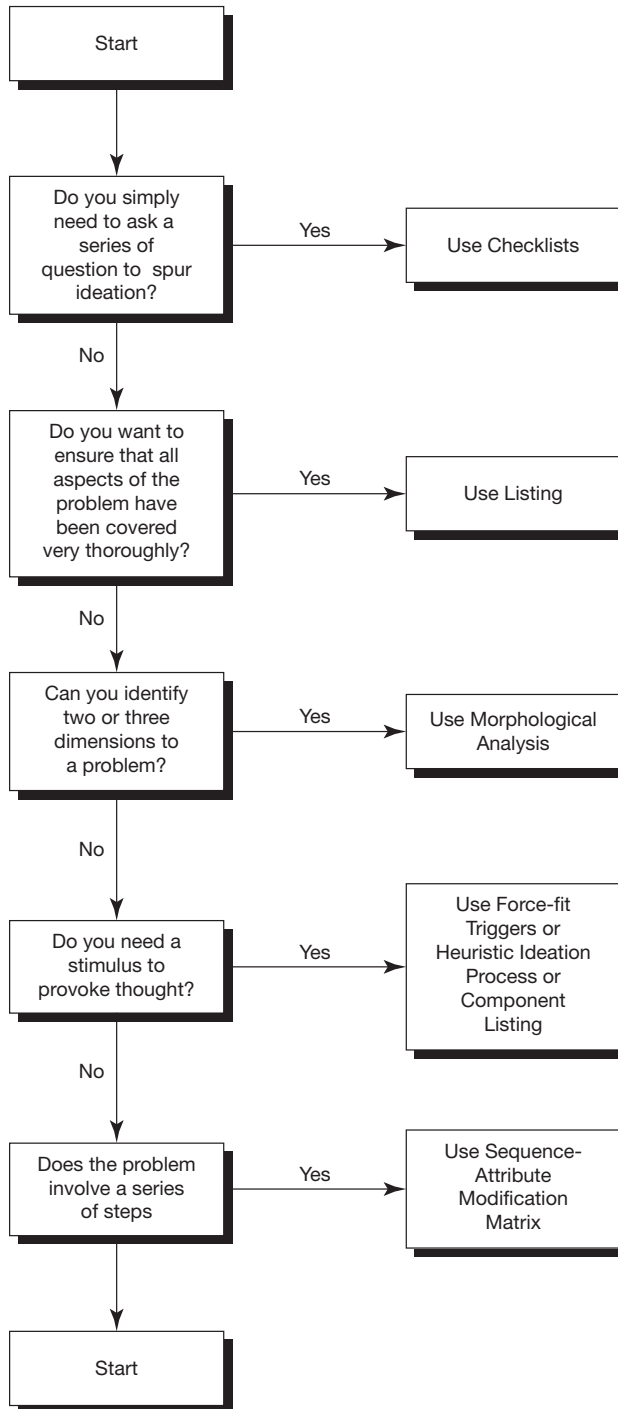


Figure 7.2
Which techniques to use

The technique facilitates idea generation by having one prepare a list of items related to a problem and checking the items against certain aspects of the problem. It can be used both as a problem-delineation list and as a solution-finding list. The purpose of the former is to provide a direction for the idea search, to make sure that no ideas have been overlooked, and to evaluate the applicability of ideas borrowed from a previous problem. Checklists used for possible solutions are concerned with developing new ideas. The most common use of checklists involves identifying new product ideas by making alterations to existing products.

Example

The problem encountered in a knitwear garment business is that, because the market is a seasonal one, in summer it is not appropriate to produce thick jumpers or cardigans. The business is therefore looking to design a new product or modify an existing one that utilizes the same system of production as the thick jumpers and cardigans. The problem is thus how to develop a new product by modifying an existing one that will be suitable for summer sales.

The checklist considers such things as:

- 1 Producing short-sleeved jumpers and cardigans instead of long-sleeved ones.
- 2 Using synthetic materials instead of wool.
- 3 Using thinner materials.
- 4 Using lighter material and not wool.

Problem-solution checklists are a simple method of preventing the oversight of obvious solutions to a problem. They also enable previous solutions to be adapted to current problems. In order to be effective the technique is best used as a supplement to more open-ended techniques.

ATTRIBUTE LISTING

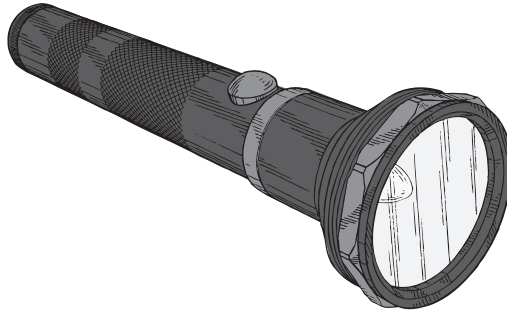
Attribute listing is a good technique for ensuring that all possible aspects of a problem have been examined. Attribute listing involves breaking the problem down into smaller and smaller bits, and seeing what can be discovered as a result.

Example

Let's say you are in the business of making torches. You are under pressure from your competition and need to improve the quality of your product. By breaking the torch down into its component parts – casing, switch, battery, bulb and the weight (the attributes of each one) – you can develop a list of ideas and you can improve each one (Table 7.1).

Table 7.1 *Attribute listing: improving a torch*

<i>Feature</i>	<i>Attribute</i>	<i>Ideas</i>
Casing	Plastic	Metal
Switch	On/off	On/off/low beam
Battery	Consumable	Rechargeable
Bulb	Glass	Plastic
Weight	Heavy	Light

**Figure 7.3***Attribute listing for a torch*

Attribute listing is a very useful technique for quality improvement of complicated products and procedures for services. It is a good technique to use in conjunction with some other creative techniques, especially idea-generating ones like brainstorming. This allows you to focus on one specific part of a product or process before generating a whole lot of ideas.

Example

Saw.

Attributes:

- central blade unit
- vertical cutting process
- constant cutting speed
- cuts light metals and light to medium woods and plastics

Improvements to central blade unit:

- possible alterations to the diameter of the blade
- alter the number of teeth of the blade
- different types of blade for cutting different materials

Improvements to vertical cutting process:

- horizontal cutting
- circular cutting
- circular trimming

Improvements to constant cutting speed:

- automatic variable speed
- manual variable speed
- cutting speed controlled by locking device

Material to be processed:

- wood
- plastic
- steel

COMPETITIVE REPOSITIONING OF A PRODUCT

There are a number of different ways of positioning a product in the mind of the consumer in order to differentiate it from competitive offerings. The positioning may be based on:

- 1 Product features – such as the low-calorie content of some foods.
- 2 Product benefits – e.g. a particular model of car as ‘the most economical way to get to work by car’.
- 3 Associating the product with a use or application – e.g. ‘the wine you have on special occasions’.
- 4 User category – associating the product with a user or class of users – e.g. ‘the car for the business executive’.
- 5 With respect to competition – e.g. ‘an IBM-compatible microcomputer’.

In addition to the five methods of positioning highlighted above there are also many less common ways.

A product or service will require its positioning adjusting from time to time. This is referred to as repositioning and can become necessary if:

- (a) a competitor’s new product or service has been positioned next to the brand and this is having an adverse effect on the product or service’s share of the market;
- (b) consumer preferences with respect to the product or service have changed;
- (c) new customer-preference clusters have been pinpointed that suggest promising opportunities;
- (d) the original positioning was incorrect.

EXERCISE

Take each of the five methods of positioning mentioned above and assume that the producer of the goods in each case wishes to reposition the product for one or other of the four reasons mentioned. Using attribute listing, identify features, benefits, associated applications, or competition-related factors – as appropriate – to suggest ways of repositioning either the products listed in the examples or other products of your own choice.

Example

A firm wants to change the style of its toffee-apple sticks. The attributes of the sticks are:

- made of wood
- used to hold toffee apples
- need to be disposed of properly once the product has been consumed

Once the list has been fully completed, each attribute is studied in turn. The information obtained was processed as follows:

Made of wood:

- Could it be made of other materials?
- Would other materials be more reasonable to purchase and work with, thus reducing the production cost?
- Could the material used be a substance that can be recycled – or even a biodegradable substance?

Usage:

- Currently hand-held, could it be changed to a free-standing toffee apple?
- Could it be flavoured to produce more taste for the consumer?

Disposability factors:

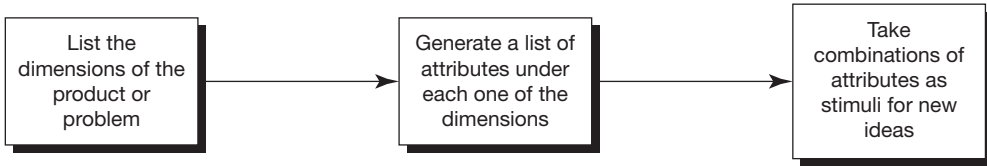
- Could the stick be made edible so that it would obviate the need to dispose of it and avoid the potential creation of litter?

MORPHOLOGICAL ANALYSIS

The technique originated in the complex technological world of astrophysics and rocket research in the 1940s and was the work of a Swiss astronomer, Fritz Zwicky (1948). It is only in recent years that Zwicky's analytical technique has emerged from the depths of research establishments and been recognized as being applicable to a wide range of situations. Zwicky made use of this method of analysis in areas such as the classification of astrophysical objects, the development of jet and rocket propulsion systems, and the legal aspects of space travel and colonization. In the more recent past, morphological analysis (MA) has been used in the fields of policy analysis and futures studies (e.g. Rhyne 1981, 1995a, 1995b; Coyle 1994, 1995; Coyle and Yong, 1996). In 1995, advanced computer support for MA was developed at the Swedish Defence Research Agency (for a description, see Ritchey, 2003b). This has made it possible to create non-quantified inference models, which significantly extends MA's functionality and areas of application (Ritchey, 1997, 1998, 2002, 2003a, 2004, 2005a, 2005b, 2006a, 2006b). Since then, some eighty projects have been carried out using computer-aided morphological analysis, for structuring complex policy and planning issues, developing scenario and strategy laboratories, and analysing organizational and stakeholder structures (Richey, 2009).

Morphological analysis is a tool that can help generate a vast number of ideas. It works best as a visual aid. However, this can prove difficult in circumstances where the problem is complex. Ideally, the problem should have two or three dimensions to permit the construction of two-dimensional or three-dimensional grids.

First, possible dimensions are listed that describe the problem or system being studied. No more than three dimensions can be represented diagrammatically, and they must be relevant and have a logical interrelationship. For example, if an organization decides to alter its product in response to changing requirements, it may consider product shape and the material out of

**Figure 7.4***Steps in morphological analysis*

which the product can be made as two such dimensions. In this case the dimensions would be represented on a two-dimensional grid (or on a cube for three dimensions), and a list of attributes is then generated under each dimension. Free-wheeling and off-beat ideas are encouraged.

The next step is to examine combinations of attributes across the dimensions, however unusual or impractical they may seem. For example, a cross may be put in a box if the combination is used at present and a nought if it is a potential one worth pursuing. Promising ideas are then subsequently evaluated for their suitability.

The technique may be used by an individual or a group. If it is used by a group, then, ideally, the group should consist of six to eight experienced people who each record their own ideas. There should be a leader who collects the ideas and who must be able to communicate enthusiastically while keeping a steady momentum going. A warm-up session is customary prior to problem solving, and this provides an opportunity to select and discuss the dimensions of the problem. It is helpful to express the problem in generic terms, to make much use of imagination, and to ensure that the dimensions and attributes are independent.

A session begins with the problem being revealed and placed where it can be seen easily. Each member of the group is asked to define its dimensions and then to read them out. A discussion then ensues on which dimensions should be used. Each member is then given a diagram on which he or she has to complete the items, and then, as with the dimensions, to read them out. The same process is then repeated with a larger diagram. Once this has been completed the leader has to try to collate all the items on to an overhead-projector transparency. Having agreed on a final joint diagram, the group can carry out other activities such as listing the five most exciting ideas, or identifying the five worst and trying to improve them.

When considering more than three dimensions, a variation called *morphological forced connections* may be applied. This uses a two-dimensional grid with the dimensions written across the top columns and the attributes, or ways that they can be accomplished, written in the cells beneath. A combination is represented by a line linking a cell from each column.

Morphological analysis is ideal for generating a large number of ideas of an opportunity-seeking or exploratory nature in a logical way. It is also a powerful tool for broadening an individual's horizons with respect to a problem. However, it is unsuitable for problems where one must focus on a narrow band of options or where a problem only has a single dimension.

Example

Suppose a firm wants to generate ideas for a new educational toy for toddlers. The first stage is to identify suitable categories of ideas to use as axes of a matrix, bearing in mind that one is seeking to discover opportunities rather than come up with an immediate solution. The chosen dimensions must be relevant to the problem and have some logical interrelationship. However, the items listed under each dimension can be as offbeat as one wants. The morphology identifies the dimensions which describe the toy and then identifies lists of attributes under each dimension (see Table 7.2, for example).

Table 7.2 *Morphological analysis: new toy for a child*

<i>Material</i>	<i>Where used</i>	<i>Educational purpose</i>
Felt	Cot	Alphabet
Rubber	Pram	Numbers
Plastic	Play pen	Shapes
Wood	Beach	Sounds
Transparent perspex	Car	Colours
Wool	Bath	Textures
Metal	Garden	Coordination
Inflatable plastic	Holidays	Smell
Luminescent	Construction	

In the example given in Table 7.2, the attributes of each dimension can be combined with each other, thus giving $9 \times 8 \times 9$ (648) possibilities. Sometimes it may be necessary to consider three or even four dimensions, but this makes the task of evaluating ideas laborious, so the two or three most important dimensions are usually chosen.

Example

Suppose the problem is how to cope with seasonal workloads. Let us assume there are two dimensions to this problem: time and money (Table 7.3). Under each of the two headings we might list attributes as they apply to the problem. There are $3 \times 3 = 9$ combinations we can consider, and we consider every combination. For example, we can take 'insufficient time' and 'cheap to hire temporary staff' as an example. This, in fact, suggests one possible way of solving the problem.

Table 7.3 *Coping with seasonal workloads*

<i>Time</i>	<i>Money</i>
Irregular hours	Expensive to pay overtime
Unsociable hours	Cheap to hire temporary staff
Insufficient time	Lack of positive cashflow

Example

A footwear manufacturer wants to extend its range into more specialized and unusual products. In this case the axes used were type (the type of footwear worn by people) and age group (the age range that might use the footwear) (Table 7.4).

Table 7.4 *Extending the footwear range to more specialized products*

<i>Type of footwear</i>								
<i>Age range</i>	<i>Boot shoe</i>	<i>Slipper shoe</i>	<i>Trainer heels</i>	<i>Sandal shoe</i>	<i>Casual</i>	<i>Work</i>	<i>High</i>	<i>Dance</i>
Baby								
Toddler								
Pre-school								
Child								
Adolescent								
Adult								
Retired								

Example

The problem is how to encourage new readers to a newspaper by producing a supplement that will be funded by advertisers. Chosen dimensions are the intended market, the type of articles and the type of advertiser (Table 7.5).

Table 7.5 *Aspects of a new newspaper supplement*

<i>Type of article</i>	<i>Intended market</i>	<i>Advertisers</i>
Sport	Pet owners	Cosmetic surgery
Cooking	Housewives	Music clubs
Cartoons	Business women	Book clubs
Cars	Female teens	Dating agency
Holidays	Male teens	Records/music
Make-up	Children	Perfume
Problems	Business men	Clothes
Horoscopes	Pensioners	Sports goods
Stories	Families	Make-up
Puzzles	Gardeners	Toys

The SCIMITAR system

Somewhat allied to the concept of morphological analysis is the SCIMITAR system developed by John Carson (Figure 7.5). In the 1980s, Carson developed a method for searching for new products (Carson and Rickards, 1979). Its idea-generation mechanism is a three-dimensional model of the company which is systematically searched to find multiple answers to the question: market needs + corporate means = ? The three dimensions are markets, processes and raw materials.

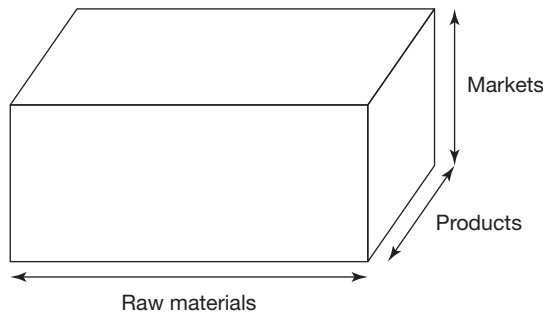


Figure 7.5
SCIMITAR

SCIMITAR has been used widely in many firms and has never failed to yield valuable new product ideas.

FORCE-FITTING TRIGGERS

Providing visual stimuli to help spark off ideas in people's minds can be a very useful technique. Here the idea is to force-fit combinations of attributes that one associates with an unrelated object to the problem with which one is preoccupied. All one needs is a set of trigger cards on which are depicted pictures or drawings of well-known objects and a flip chart on which one records the attributes generated and the subsequent implications for the problem itself.

The procedure is as follows:

- 1 Choose three different trigger cards showing pictures like those shown in Figure 7.6 and draw a column for each on a flip chart (three columns).
- 2 Ask the assembled group of individuals to call out in turn the first thing that comes to mind when they think of the item on the trigger card. Fill each column on the flip chart with these ideas.
- 3 Describe the problem to be solved. Get the group to find solutions that make use of at least one word from each of the three columns.
- 4 Move from less sensible to sensible solutions.



Figure 7.6

Force-fitting process and triggers 1

Imagine that one is working on the problem of improving interdepartmental communications and that the three pictures in Figure 7.7 have been selected to help come up with ideas. First one lists attributes or associations for each picture:

Bull:

- Spain
- fighting
- dangerous
- powerful
- has horns
- steer
- part of the food chain

Aircraft:

- jet powered
- uses a lot of fuel
- fast
- flies high
- takes people on holiday
- creates atmospheric pollution
- has a pilot and crew

Mother and child:

- safe and secure
- loving relationship
- warm
- friendly
- daring
- lasting relationship

(1) Has horns + flies high + warm and friendly

Stress the powerful effect and importance of making sure that all organizational units communicate with one another in a warm and cordial manner.

(2) Steer + has a pilot and crew + lasting relationship

Need to provide written guidelines or training to enable employees to develop durable and lasting good-practice methods of interdepartmental communication.

EXERCISE

Using combinations of three of the trigger cards shown in Figure 7.7, suggest insights, ideas or solutions for each of the following problems:

- 1 How to get greater commitment to the organization from employees.
- 2 How to deal with difficult customers.
- 3 How to recruit high-calibre management staff.
- 4 How to increase productivity on the shop-floor.
- 5 How to reduce thefts from supermarkets.
- 6 How to close a sale.

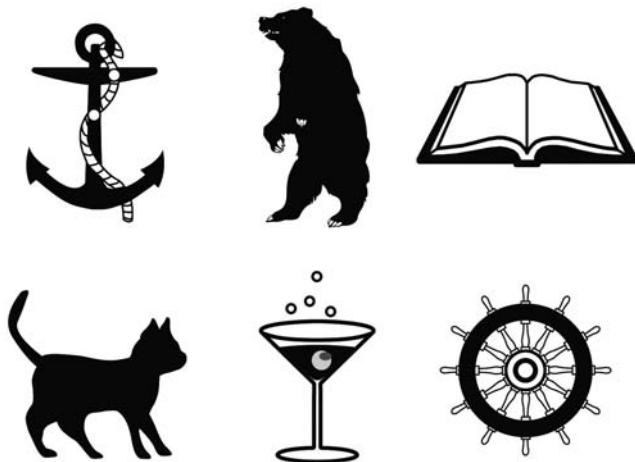


Figure 7.7

Force-fitting process and triggers 2

HEURISTIC IDEATION TECHNIQUE

This technique provides an interesting variation in the approach to suggesting new product ideas. In principle, the technique reflects those suggested by Tauber (1972). The approach breaks down the structure of existing products into lists of factors or attributes. A desktop computer, for example, could be broken down into such items as monitor, mouse, keyboard, processor, etc. The next step is to take another product and to break that down into its elements as well. Lists of the two sets of components are then arrayed next to one another and different combinations (one from each list) are taken as stimulation for thought.

Example

An out-of-town holiday hotel is looking for ideas for augmenting its service to guests; a hospital is used as the other product:

Hotel (factors: accommodation, entertainment, eating facilities, transportation).

Hospital (factors: nurses, doctors, diagnostic equipment, operating theatres, ambulances).

Various combinations are listed and numbered:

- 1 accommodation: nurses
- 2 accommodation: doctors
- 3 accommodation: diagnostic equipment
- 4 accommodation: operating theatres
- 5 accommodation: ambulances
- 6 entertainment: nurses
- 7 entertainment: doctors
- 8 entertainment: diagnostic equipment
- 9 entertainment: operating theatres
- 10 entertainment: ambulances
- 11 eating facilities: nurses
- 12 eating facilities: doctors
- 13 eating facilities: diagnostic equipment technique
- 14 eating facilities: operating theatres
- 15 eating facilities: ambulances
- 16 transportation: nurses
- 17 transportation: doctors
- 18 transportation: diagnostic equipment
- 19 transportation: operating theatres
- 20 transportation: ambulances.

All kinds of possibilities are suggested by these combinations. For example, combinations 1 and 2 suggest a resident doctor and nurse. Combination 3 suggests the installation of different kinds of diagnostic equipment (of a non-medical nature) to help guests with their problems – e.g. an information desk, a computer terminal with an expert system to help with the most common queries, etc. Combination 5 suggests a free daily transportation system into the town, returning later in the day at specific times to pick up guests and return them to the

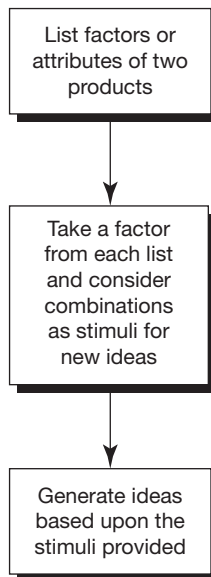


Figure 7.8

Heuristic ideation technique

hotel. There are many more interesting possibilities that can be found by looking at the various combinations and using a little imagination.

The method presents a systematic way of generating a relatively large quantity of ideas. Careful attention, however, has to be given to ensure that all the relevant important factors are included.

COMPONENT DETAILING

This method, suggested by Wakin (1985), makes use of some of the features of both attribute listing and morphological analysis. It is a technique suitable for use with a group of investigators. The procedure is as follows:

- 1 The major components of the problem are listed.
- 2 The attributes of each component are noted and listed.
- 3 Different problem components are allocated to different group members for study.
- 4 The components and their attributes are studied and noted in detail.
- 5 A picture is drawn of each component, including as much detail as possible.
- 6 Drawings are collected and displayed where they are visible to all those involved in the exercise. The pictures should be displayed, paying attention to their logical ordering.
- 7 The collage is reviewed for possible ideas.

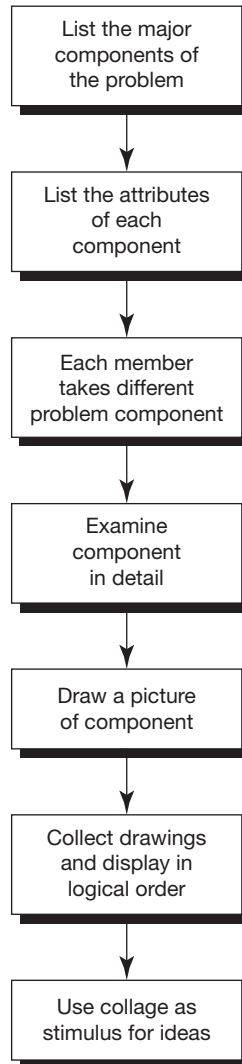


Figure 7.9
Component detailing

The method is useful when one is looking for ways to improve a product service or process. The technique helps people to see a problem from new perspectives by using drawings that vary in size and drawing style. While it is obviously most useful for dealing with tangible products or processes, most services do have tangible aspects, and these might be depicted pictorially. Abstract representations can also be effective and provide interesting and thought-provoking insights.

SEQUENCE-ATTRIBUTE MODIFICATION MATRIX

This is a useful method to adopt when examining a problem that comprises a logical sequence of steps. It makes use of aspects of attribute listing, checklists and morphological analysis (see Brooks, n.d.). It also requires the user to apply forced relationships in order to stimulate ideas. The steps involved are as follows:

- 1 Enumerate the logical steps involved in the problem under consideration.
- 2 Indicate ways in which the process can be altered (e.g. eliminate, substitute, rearrange, reverse, combine, increase, decrease, magnify, etc.).
- 3 Construct a two-dimensional matrix such that the steps appear vertically along the left-hand edge of the matrix and the modifications horizontally along the top of the matrix.
- 4 Examine the matrix cells for instances where change seems to be promising or where further study would be productive.
- 5 Suggest ways of introducing the changes identified.

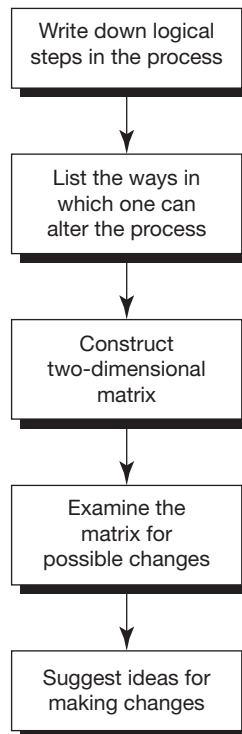


Figure 7.10

Sequence-attribute modification matrix

Example

Problem: poor record of recruitment of sales office staff. Staff turnover high and average length of stay less than three months. Personnel and the line manager recruit and appoint staff.

- 1 Steps followed in the process:
 - (a) Keep records of all jobs in the sales office and their job specifications.
 - (b) Update and modify job specifications from time to time.
 - (c) Place advertisement in the media when a vacancy arises.
 - (d) Send out details of job specifications to all applicants for posts.
 - (e) Short-list suitable applicants for interview.
 - (f) Conduct face-to-face interviews with applicants.
 - (g) Take up references for those who appear to be interesting.
 - (h) Send out offer to successful candidate.
- 2 Substitute, rearrange, combine, increase, decrease, improve, eliminate.
- 3 Construct matrix using the following abbreviations for steps in the process:
 - (a) Keep records.
 - (b) Update records.
 - (c) Place ads.
 - (d) Send job details.
 - (e) Short-list.
 - (f) Interview.
 - (g) References.
 - (h) Offer.
- 4 Construct a two-dimensional grid (see example on facing page).

Observations

- The way in which job descriptions are kept and the frequency with which they are updated might be improved. More frequent updates and a review of the kind of information included in the job descriptions might be productive.
- When jobs are advertised in the media they might be combined with other job vacancies so that a bigger display can be purchased in the press. This might catch the attention of more prospective employees. It could be good policy also to increase the number of outside media in which a job is advertised and to advertise it internally as well. The number of times an advertisement appears might also be increased. Generally, the quality of the advertisements needs to be looked at. This will be particularly the case if the switch to advertising more than one type of job in the same advertisement is adopted. Professional advice of an advertising agency would be useful in this matter.
- The quality of the information given out to prospective applicants also needs to be re-examined. After all, such material is part of the internal marketing operations of the company and it needs to sell itself to prospective employees. Good applicants may be deterred from applying if they are not convinced that the job represents a really good opportunity.

	Substitute	Rearrange	Combine	Increase	Decrease	Improve	Eliminate
Keep records						X	
Update records				X			
Place ads			X	X		X	
Send job details						X	
Shortlist				X			
Interview			X				
References							
Offer	X						

Figure 7.11

Two-dimensional grid facilitating sequence-attribute modification matrix

- The policy of how many candidates to interview needs to be reviewed. It is possible that the firm should consider short-listing more applicants than has been the practice in the past.
- A single interview lasting half an hour may not be adequate for this type of post. Other selection and screening methods need to be considered. Prospective applicants could be invited to meet staff in the office over coffee and to spend some time in the office in order to get some idea of the kind of work that is being undertaken. This could be combined with the formal half-hour interview.
- When it comes to making offers the current practice is to make an offer on the day. It might be better practice to ring the successful candidate on the day following the interview. If there is a good alternative candidate and the first candidate declines the offer, then an appointment can still be made without incurring additional cost or missing out on an opportunity altogether.

QUESTIONS

- 1 What are the principles that lie behind morphological analysis? Illustrate how you might use the technique on a problem of your choice.
- 2 Evaluate the use of checklists from the point of view of aids to ideation.

- 3 How would you use a checklist to find improvements for the following products?
 - (a) hair rollers
 - (b) washing powder (clothes)
 - (c) shoes
 - (d) new edition of a textbook.
 - 4 Suggest how you might use attribute listing to find improvements for the following:
 - (a) desktop computer
 - (b) wedding
 - (c) funeral
 - (d) checking in at an airport
 - (e) fun fair.
 - 5 Use the force-fit images in the text to find insights into the following problems:
 - (a) how to improve the customer service level in a bank;
 - (b) how to make money on the stock exchange;
 - (c) how to reduce scrap level when producing machine parts/components;
 - (d) how to reduce employment turnover of staff.
 - 6 Use a method that would enable you to come up with ideas about adding utilities to a comb.
 - 7 Illustrate how the heuristic ideation technique might be used to come up with ideas for improving the level of customer service in restaurants.
 - 8 Illustrate how you might use component detailing to tackle the problem outlined in question 7 above.
 - 9 Illustrate how you might use the sequence-attribute modification process on a problem of your choice. What are the limitations of this method?
-

CASES

Super-liners

The 'queens' were the largest and heaviest ships ever built. Their working lives were curtailed by the advent of jet-powered air passenger services across the Atlantic. It was not the end of large passenger ships, however, for a new type of holiday became fashionable – the cruise holiday. Smaller, though very substantial ships were built to ply cruise routes around the Mediterranean, the Caribbean and other attractive holiday areas of the world. Modern-day cruise liners are like floating hotels, offering many different forms of entertainment, accommodation and ranges of prices to suit the needs of customers.

Recently, a new breed of cruise liner has appeared on the scene. These are super-liners, larger than the old 'queens' and designed to be much more spacious. They even boast golf-courses! These are mini floating cities, not just floating hotels. Even larger super-liners are planned and there seems to be no limit to how large these vessels can be.

Question

How might the new super-liners be suitably equipped to make best use of their size to provide entertainment and other facilities for customers?

Getting more involvement in church affairs

The local church is looking for ways of encouraging parishioners to be more involved in church matters. It always seems to be the case that the same few people do most of the organizing of events while the large majority participate by attending whatever has been organized for them. The vicar feels that some creative thinking is called for, and someone mentions to him that there is a creative problem solving technique called morphological analysis which might help them to come up with some ideas.

Question

Identify what you consider to be the main dimensions to this problem and generate a list of attributes under each heading. Which combinations, in your opinion, seem to be pertinent to the vicar's needs in this case?

Delta Engineering

Delta Engineering manufactures circuit boards for use in desktop personal computers. At present it supplies one standardized board – without any subassemblies or attachments – to a number of different producers of desktop computers.

The firm is looking to expand its product-market scope and recognizes that tailor-made circuit boards or other partly assembled boards may be possible avenues for exploration. However, it also recognizes that circuit boards are used in many other products and may well differ in terms of specification for different market segments. In addition, there are obviously other factors that have an important bearing on what the firm might do.

Question

Assess the usefulness of morphological analysis in this case in terms of assisting the firm to come up with ideas or insights into the problem.

Kay's café

Northport is to get a facelift. Many millions of pounds, donated by the EU, are to be spent on turning a reasonably prosperous seaside resort into a trendy, desirable location for families, singles and even the aged.

Kay's café is halfway along a side-street which leads directly on to the main promenade. Some 100 yards further inland is the more prosperous Noble Street, tree-lined and populated with high-class retailers for many different products, as well as some dozen or so high-class cafés and restaurants. Kay's café is run by Gemma along with Nora and Stoker (the waitress and waiter, respectively). Gemma spends all her time behind the till, while Nora and Stoker take it in turns to wait on tables or rustle up the food and drink.

The café has been there for more than twenty years and attracts a regular clientele of passersby as well as some seasonal trade from holidaymakers in the spring and summer. Tea, coffee, fruit drinks, sandwiches and cakes make up the menu. With the exception of the sandwiches and the coffee and tea, which are made on the premises, the other items are bought in. Cakes are delivered each morning to the shop by a local baker.

The promised change to Northport was reported at length in the local newspapers, along with the notice that retailers might be able to qualify for a grant to modernize and revamp their premises if they could argue a sufficient case with the holders of the money. Gemma, the proprietor of the café, was most enthusiastic about this possibility and immediately went into raptures about how they would profit well from this development. Stoker, in his usual guarded way, pointed out, however, that they would need to come up with some pretty good ideas if they were to stand any chance of qualifying for the money. 'After all,' he said, 'it will take more than home-made sandwiches and plastic seats and table-cloths to show that the café is going to be one of the star attractions of the new Northport.'

Question

Illustrate how morphological analysis, or one of the other techniques described in this chapter, can help Gemma and her colleagues to come up with good ideas for how they might develop the café.

Flat panels

While it would be foolish to speculate about trends far into the next millennium, it does seem clear that during the first ten years the flat panel display (FPD) industry should experience growth rates well in excess of broad-based industrial averages and the more mature segments of the electronics industry. Two factors could drive this growth. The first is increased penetration of the computer monitor market, following on the successes achieved in notebook computers, which were enabled by the development of high-resolution multicolour liquid crystal displays (LCDs). During the last few years, the number of LCDs sold as desktop monitors has grown tenfold, but penetration of this market is still less than 5 per cent. Dominance of the computer monitor market will be followed by an assault on the digital television market. This growth will be achieved almost entirely through sustained incremental development of the leading technology, active matrix liquid crystal displays (AMLCD), controlled by thin-film transistors (TFTs) made from amorphous silicon on a glass substrate.

The second opportunity for growth is through the emergence or maturation of other markets, such as electronic books and Internet appliances. There are opportunities for disruptive technologies, developed by companies that are not now market leaders but are willing to develop emerging technologies especially suited to new applications.

While the last ten years have seen continued battles between leading Asian manufacturers for market share in the production of LCDs, this business has yet to yield steady profits – enough to justify the large investments made by manufacturers and their suppliers. Cycles have been particularly vicious, with over-investment in good times leading to over-supply and deep discounting to keep lines operational. The major challenge in the next decade will not be just to achieve further increases in revenue, but to do this in a fashion that allows for profitability for participants at all levels in the supply chain.

Question

Suggest marketing opportunities for flat panel displays.

SMS texting and the council

A proposed project involves the use of text messaging in conjunction with Natural Language Processing (NLP) technology to interpret and direct communications to appropriate sources for decoding and providing communicator-satisfying responses. It represents an innovation in service enquiry and provision. People making use of such a system may be either external customers enquiring about the use of the city council's services or the council's own employees (internal customers) needing to find out more about council-related matters. The government is committed to a fundamental reform of public services, and people and businesses must be able to deal with government when they want, where they want, how they want. People must also be confident that they will receive high-quality services that they can trust. The government aims to make all its services available electronically by 2005 and it has made progress in this direction since more than 50 per cent of services are now available electronically. The Office of the Deputy Prime Minister (ODPM) has also established an £80 million programme of Local Government Online (LGOL) National Projects.

The goal of NLP is to design and build a computer system that will analyse, understand and generate natural human languages. Applications of NLP include machine translation of one human-language text to another; generation of human-language text such as fiction, manuals and general descriptions; interfacing to other systems such as databases and robotic systems, thus enabling the use of human-language type commands and queries; and understanding human-language text to provide a summary or to draw conclusions. This is an emergent technology which is able to theme, analyse and process large amounts of data received from multiple sources, and output the results of this analysis in the form of natural language responses.

Question

Suggest possible communication applications for the system both between the council and members of the public and other organizations, and, within the council itself, between departments and individuals.

FURTHER READING

- Hussain, N., Garvey, B. and Ritchey, T. (2013) SWOT analysis using general morphological analysis: application to the specials sector for new business drivers, *European Journal of Industrial Pharmacy*, 15, December (download PDF).
- Ritchie, T. (2011) *Wicked Problems – Social Messes: Decision Support Modelling with Morphological Analysis*, Springer-Verlag Berlin Heidelberg, available at: www.springer.com/cda/content/document/cda_downloadaddocument/9783642196522-c1.pdf?SGWID=0-0-45-1173250-p174106575 (accessed 15 April 2013).
- Voros J. (2009) Morphological prospection: profiling the shapes of things to come, *Foresight* 11(6).

Brainstorming and its variants

Underproductive meetings

How many times do we have meetings, raise issues and problems, and then go away without any real conviction that what we have decided to do is really the only possible way of tackling a problem? Often there is a feeling that there might have been a better approach to dealing with a particular problem if only we could have come up with an idea that we feel was lurking at the back of our mind. Indeed, it could be several months later that we suddenly realize that another way of tackling the problem would have produced a better solution! If only we had thought of it at the time!

Brainstorming is a paradigm-preserving approach to creative problem solving that enables us to gain insights into problems that otherwise we might overlook. It enables us to bring to mind those other solutions that somehow always seem to evade us when we most need them.

INTRODUCTION

The chapter reviews some of the more popular forms of brainstorming. These include classical brainstorming, wildest idea variant, round-robin brainstorming, Gordon–Little variant, trigger method, brainwriting and brainlining (brainstorming on the Internet). Limitations of brainstorming as a method are also examined. Brainstorming is perhaps the most popular of the creative problem-solving techniques. It essentially encourages people to work within existing paradigms, though the introduction of wild ideas may on occasion lead to paradigm stretching by moving the thought processes of participants away from the problem in hand. It is a technique that should appeal to most participants irrespective of whether they are essentially divergent or convergent thinkers. In a group situation, having a mixed range of thinking styles, learning styles and personalities can be advantageous, and in addition one should bear in mind the caveat regarding group dynamics mentioned in Chapter 5.

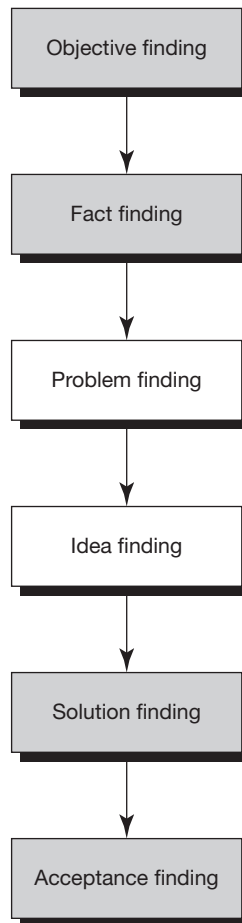


Figure 8.1

Position of this chapter within the CPS process

CLASSICAL BRAINSTORMING

A form of brainstorming was practised in Asia over 3,000 years ago; however, in modern times its popularization has been attributed to Alex Osborn in the 1940s and 1950s (Rickards, 1988). Most brainstorming techniques fall into two categories: unstructured and structured. Unstructured brainstorming is not guided by any agreed-upon set of procedures. The result is often an unproductive session. A good example of structured brainstorming is *classical brainstorming*. It is based upon a few major principles and was originally recognized and used from the early 1950s.

Osborn (1953) advocated the virtue of ‘deferment of judgment’ as an aid to creativity. Later work at Buffalo in the United States by Parnes (1963) supported Osborn’s claims that, through the deferment-of-judgement principle, more and more good ideas could be produced in unit time. Osborn had four basic rules for brainstorming:

- 1 Criticism is not permitted – adverse judgement of ideas must be withheld.
- 2 Free-wheeling is welcome – the wilder the idea the better. One should not be afraid to say anything that comes into one's mind. This complete freedom stimulates more and better ideas.
- 3 Quantity is required – the greater the number of ideas, the more likelihood of winners.
- 4 Combinations and improvements should be tried out. In addition to contributing ideas of one's own, one should suggest how ideas of others can be improved, or how two or more ideas can be joined into a still better idea.

Brainstorming can be used to help find solutions to many different kinds of open-ended problem – for example, trouble-shooting problems (how to reduce downtime on the production line; how to reduce shoplifting in the store) and problems where a large number of ideas are required (identifying new product concepts; new market/segment concepts; names for products or companies). Unsuitable problems might include those that require technical or professional expertise beyond the capability of the members of the group or those that have only one answer.

The term 'brainstorming' has become a commonly used word in the English language as a generic term for creative thinking. The basis of brainstorming is generating ideas in a group based on the principle of suspending judgement – a principle that scientific research has proved to be highly productive in individual effort as well as in effort. The generation phase is separate from the judgement phase of thinking.

Good brainstorming is part of a creative cycle of expansion and contraction. The first phase, expansion, relies on unleashing one's creativity. The second, contraction, demands the use of judgement to focus on the best or most relevant ideas.

Rules of brainstorming

Brainstorming is a tool to generate ideas, and some ground rules are needed to maintain order. Following four rules will maximize productivity:

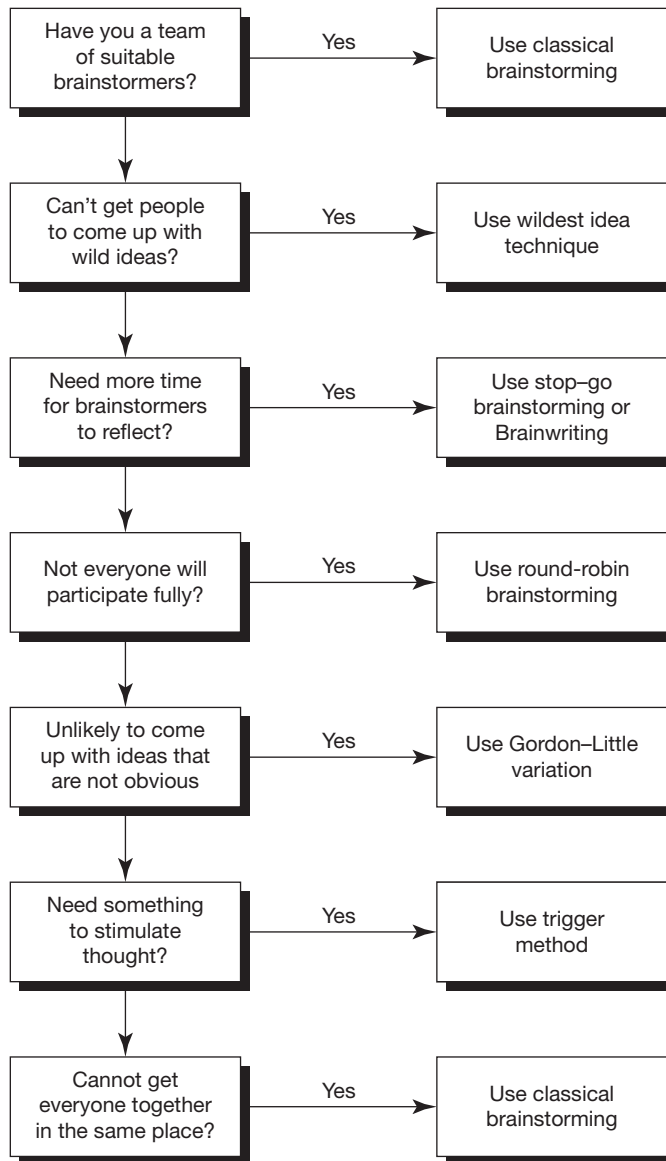
- Evaluate later
- Encourage wild ideas
- Go for quantity
- Build on other ideas

Evaluate later

One does not have to defend or explain ideas. Evaluating or explaining interrupts the process and can make it hard to generate ideas. All ideas put forward are equally valuable, and people are apt to hold back their ideas if they feel they may be ridiculed.

Go for quantity

The generation of many ideas opens up a wide range of possibilities. This quantity has two dimensions: *flexibility* and *fluency*.

**Figure 8.2***Overview of some brainstorming methods*

Flexibility reflects a range of different classes of ideas. Imagine one is brainstorming for frozen items to sell in a store. The list might include ice cream, microwave dinners, concentrated fruit juice and desserts. This shows flexibility; the variety of types of products is high.

Fluency reflects a variety of ideas clustered around a common theme. Returning to the frozen food, the list may contain several kinds of ice cream, including Raspberry Ripple, Rum and Raisin, and Vanilla and Chocolate. The fluency of ice-cream-related ideas is also high.

Encourage wild ideas

Everyone can think of wild ideas. For example, one should look beyond trying to satisfy the customer. One should try to create ideas that can:

- dazzle customers
- leave them feeling breathless.

Build on other ideas

Ideas that are shared during brainstorming can inspire even more ideas. Osborn believed that modifying or combining ideas could lead to new and even better ones. These ideas come from people with the creative skill of elaboration. They are able to expand an idea or take it in a new direction. Elaboration may happen spontaneously. Combining two ideas that might not seem closely related can produce a better idea. It will certainly produce a wild one.

Brainstorming is a traditional approach to creative thinking. The whole idea of brainstorming is that people's thoughts act to stimulate one another and produce a chain reaction of ideas. There are many variants to brainstorming.

THE PROCESS OF BRAINSTORMING

A brainstorming session needs to be well planned, and those who take part as group members need to be well briefed beforehand on how the sessions are to be conducted and on the rules they will be expected to apply. The brainstorming group should comprise 10–12 people: a leader, a scribe, and 8–10 regular and guest members. Ideally, it should take place away from the everyday place of work. The room needs comfortable chairs, flip charts, Blu-Tack and marker pens.

There are a number of stages to brainstorming. A formal statement of the problem is given by the client. The brainstorming group then attempts to interpret the goals or objectives of the situation. A good technique for understanding goals is to use the 'how to' approach. For example, when looking for good new product ideas the problem might be variously defined as:

- 1 The client should be asked to state the problem and clarify any aspects that appear confusing to the group members.
- 2 The problem is recorded along with any redefinitions produced by the group.
- 3 The client picks the most useful redefinitions, which are then used for idea generation.
- 4 Ideas are then generated.

A formal statement of the problem is given by the client. The brainstorming group then attempts to interpret the goals or objectives of the situation. A good technique for understanding goals is to use the 'how to' approach. For example, when looking for good new product ideas the problem might be variously defined as:

- How to introduce new products which are winners (problem as given).
- How to identify winning new products (sub-problem).
- How to satisfy customers' wants and needs (looking at the problem in a new way).
- How to get the horse first past the post (metaphorical approach).

The client is invited to indicate the most useful redefinitions, and redefinitions continue focusing on what the client has indicated as a fruitful direction. Finally, the client selects one or more redefinitions for ideation purposes and the group then begins to generate ideas for each one of the selected problem redefinitions in turn.

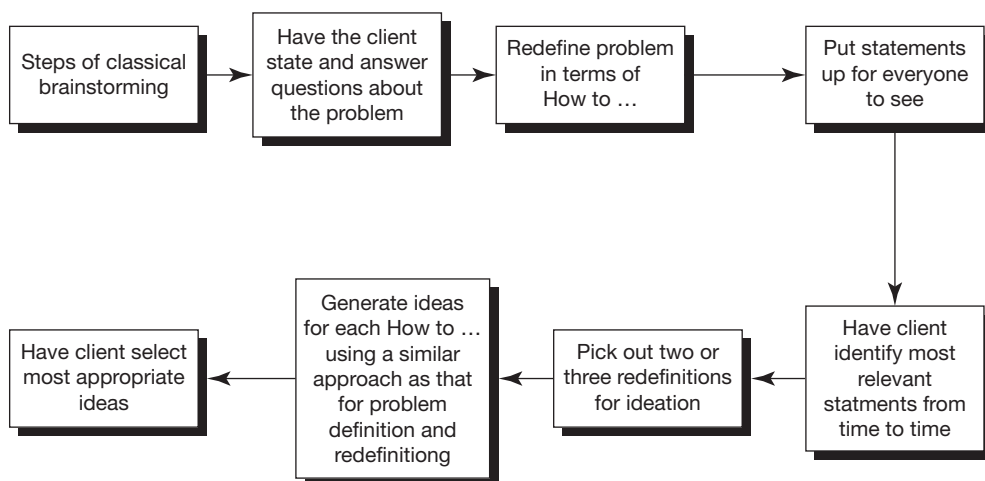


Figure 8.3

Classical brainstorming steps

Example 1

Problem as given:

- How to decrease production times.

Redefinitions:

- How to increase the use of computers.
- How to improve the efficiency of the workforce.
- How to generate flexibility.
- How to replace batch production with continuous production.

Problem taken:

- How to improve the efficiency of the workforce.

Ideation stage:

- Job sharing between departments.
- Introduce performance-related pay.

- Encourage social outings.
- Give workers super powers.
- Get rid of lunch breaks.
- Discuss how to achieve common goals.
- Bring in organizational consultants.
- Replace workers with computers.

Example 2

Problem as given:

- How to make the manufacture and marketing of cartons more profitable.

Redefinitions:

- How to identify new and profitable uses for a carton.
- How to satisfy customer wants.
- How to be the early bird and catch the worm (gain entry to new markets).

Problem taken:

- How to identify new profitable uses for a carton.

Ideation stage:

- | | |
|---------------------------------|-------------------------------|
| • shoe boxes | • boards for notices |
| • folders | • video-cassette and tape box |
| • components for picture-frames | • egg holder |
| • advertising material | • envelopes |
| • hardware packaging | • wrapping material |
| • pencil cases | • chocolate packaging |
| • theatre stage decor | • perfume box |
| • dress models | • paper bin |
| • drawing and painting pads | • desk organizer |

Example 3

Problem as given:

- A clothes manufacturer is facing resistance from employees to the frequent changes to job and work methods that developments in the product and production methods have forced upon them.

Redefinitions:

- How to make employees more enthusiastic to new methods.
- How to make new methods more welcome.
- How to make the rewards more appealing.
- How to determine what kinds of rewards to give.
- How to achieve the appropriate balance between new methods and rewards.

First redefinition taken:

- How to make employees more enthusiastic to new methods.

Ideas:

- 1 Give them incentives.
- 2 Make them cooperate.
- 3 Ask them what would please them.
- 4 Make the new methods appear challenging.
- 5 Introduce benefits with each new method introduced.
- 6 Reduce negative responses towards new tasks.
- 7 Train the employees to become more flexible.
- 8 Alter the inspection routines.
- 9 Show them that cooperation will be to their benefit.

Second redefinition taken:

- How to make rewards more appealing.

Ideas:

- 1 Ask the employees themselves.
- 2 Look at a crystal ball.
- 3 Give them non-monetary rewards.
- 4 Make them offers they cannot refuse.
- 5 Offer holiday trips and parties.
- 6 Tell them what they will lose if they do not co-operate.
- 7 Ask someone who knows.
- 8 Show them the punishments.

The answer seems to lie in reducing or eliminating the hostility towards the new ways of performing jobs or tasks. Employees may be persuaded to have a more positive attitude if some kind of reward is offered with each new method that they learn. This way new methods will appear challenging rather than threatening. For example, learning a new method might be rewarded with token points. After collecting a certain number of points, employees might be offered a special reward such as three days' additional paid leave.

Brainstorming is used most frequently to generate as many solutions to a particular problem as possible because quantity is favoured over quality. The product of a brainstorming session is ideally a wide range of possible ideas that can be presented to a client. The basic assumption is that 'two heads are better than one' and that together, in groups, innovative solutions can be found.

Most of the problems faced by organizations are not well structured. They do not have any obvious steps or parts, and there is no obviously right or wrong answer. Such problems are referred to as 'poorly structured'. Creative thinking is required to make decisions on poorly structured tasks. For example, a company deciding how to use a new ingredient in its consumer products is facing a poorly structured problem. Other poorly structured problems might

include coming up with a new product name, image or logo, or finding new or original uses for familiar objects like a coat-hanger, paper-clip or brick.

WILDEST-IDEA VARIANT

Getting really good insights into a problem can often be greatly assisted by participants introducing wild ideas into the proceedings. It is the leader's responsibility to ask the participants to make this kind of contribution. Wild ideas may not be productive in themselves but they can spur others on to think of more practical ideas.

Sometimes, however, the group may experience difficulty in generating wild ideas – this is often the case with less experienced groups. In such an instance the leader may suspend the normal session and introduce a variant of brainstorming that encourages people to speculate. When this is done, members of the group are actually asked to write down a fantasy or dream-like solution to the problem. Next, the various suggestions are collected and written on the flip chart. Each fantasy idea is then brainstormed until a realistic idea is found.

Example

PROBLEM:	Reducing the amount of paperwork in the office.
FANTASY SOLUTION:	Do without all the paperwork in the office.
PRACTICAL SOLUTION:	Use email for everything, except where paperwork is absolutely essential.

STOP-AND-GO BRAINSTORMING

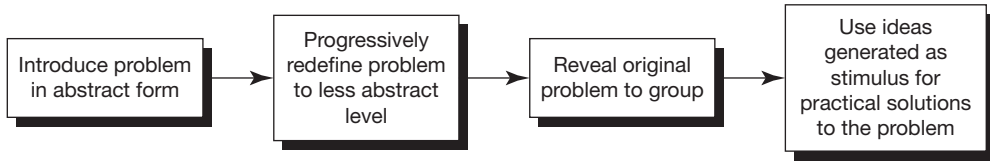
The procedure here is similar to classical brainstorming except for the fact that the session is divided up into segments. Rest periods are introduced every 3–5 minutes or so to allow participants to gather their thoughts and peruse the ideas that have been recorded up to that point.

ROUND-ROBIN BRAINSTORMING

Here again the rules are the same as those for classical brainstorming, but, instead of the participants being encouraged to shout out ideas at random, each person in turn is asked to make a contribution. The 'round' is repeated several times until it appears that ideas have dried up or until a fixed period of time has elapsed.

GORDON–LITTLE VARIATION

This variation was suggested by William Gordon while he was working for the Arthur D. Little organization. Gordon noted that participants in brainstorming sessions often look for ideal or obvious solutions and once these have been found suspend their really creative thinking. To obviate this problem he suggested a procedure that initially avoids presentation of the problem to be solved. Instead, the leader guides the group in focusing on the underlying concept or

**Figure 8.4***Gordon–Little variation*

principle of the problem. Only gradually does the leader reveal more and more information as different ideas are developed.

The steps involve the following:

- 1 Introduce the problem in an abstract form and ask participants to suggest ideas for solving the problem in this abstract form.
- 2 In the course of the ideation process the leader introduces key pieces of information associated with the problem. As a result of this information the problem is progressively refined to a less abstract level.
- 3 The leader eventually reveals the original problem to the group.
- 4 Using previously generated ideas as stimuli, the group generates ideas with regard to the specific needs of the original problem.

Example

Suppose the real problem is to do with implementing change in the workplace:

- 1 The problem is first introduced in an abstract form – e.g. how to get something off the ground. Suggestions might include ‘attaching it to a balloon’.
- 2 After ideas have been exhausted at this level the leader might suggest that the problem involves getting a new project off the ground. Suggestions at this stage might include ‘extensive consultation with everyone involved in the project’.
- 3 When the problem is eventually revealed, the suggestions at stages 1 and 2 might be usefully modified to produce novel insights into the real problem.

The Gordon–Little variation is an interesting one, but one of its drawbacks is that it doesn’t readily allow for problem definition – unless, of course, the method itself is used to define the problem. Using it in the latter way will unfortunately preclude its use for generating ideas for the same problem.

TRIGGER METHOD

The trigger method is often used in conjunction with classical brainstorming (see Bujake, 1969). The procedure adopted is as follows:

- 1 Read out a statement of the problem to the group.
- 2 Ask each member of the group to record ideas in silence (allow five minutes for this).
- 3 One member of the group is then asked to read out his or her ideas to the rest of the group.
- 4 The ideas read out are then discussed by the rest of the group for about ten minutes with the objective of developing variations on the ideas or even new ideas.
- 5 The procedure continues until all ideas have been discussed.

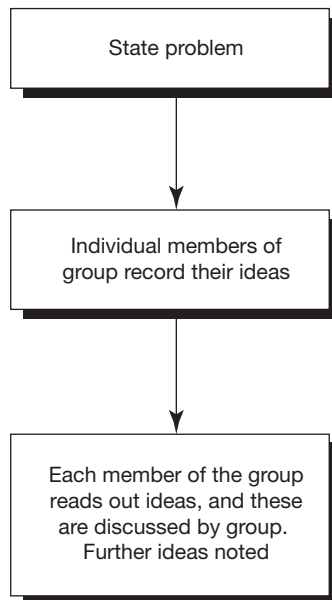


Figure 8.5
Trigger method

PROBLEMS WITH BRAINSTORMING

There are problems with brainstorming. It is 'still hopelessly misunderstood and badly executed by managers who assume that any discussion of ideas is automatically brainstorming' (Rickards, 1985: 55). The term is frequently used incorrectly, and success depends on the experience and skills of the group leader. Moreover, brainstorming is a thought-skimming technique and not always enough to help staff grappling with 'stuckness' on an issue, or with strategic decisions (Rogers, 1993).

According to Hicks (1991), brainstorming as a creative problem solving tool has its limitations. While it is useful for acquiring large numbers of ideas, it is better suited to conceptually simple problems, as opposed to the more complex development of those ideas. Brainstorming also relies on random association and therefore does not always produce original solutions. Brainstorming is not a suitable technique for a number of situations, including those with a high technical content, people motivation and problems requiring the consideration of written material.

BRAINWRITING

Brainwriting is used by individuals or a group to put ideas in writing. Each person writes their ideas down on index cards, self-adhesive notes or slips of paper. Large groups find it helpful because everyone gets to express their ideas completely and quickly. Individuals can write their ideas down in a private, quiet place and share them later. To use it by oneself is easy:

- 1 Get a stack of index cards, self-adhesive notes or slips of paper.
- 2 Pick or be asked a question that requires a new, fresh answer.
- 3 Sit down, relax and write down every idea on a separate card and initial it. One uses the rules of brainstorming and the skills needed to make them work.

BRAINLINING

Brainstorming over the Internet became known as ‘brainlining’. The word combines the words ‘brainstorming’ and ‘online’, which describes fairly well what is meant by brainlining. The word also refers to live, real-time, online sessions, incorporating special techniques, and focused on generating ideas for solving specific problems.

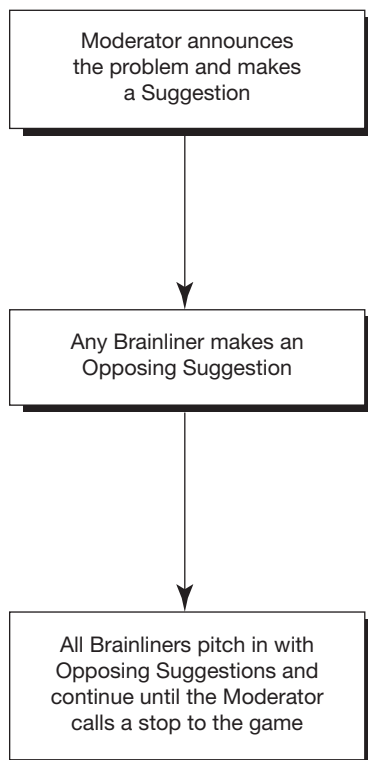


Figure 8.6
Brainlining

With the growth of online services, the process of exchanging and building upon the ideas of groups of people has occurred spontaneously. Online forums, for example, can be thought of as on-going brainstorming sessions to the extent that they allow for the free flow of ideas.

Brainlining sessions can make use of games designed for the peculiar dynamics of online idea generation. Brainlining games stimulate the flow of ideas, encourage humour and make the process fun.

Brainlining is extremely efficient. It allows all participants to enter ideas simultaneously. All ideas are visible, everybody can see every idea, and all ideas are recorded and available to all participants after the session has ended.

Brainlining also introduces the leadership of a trained moderator who conducts each session and introduces special stimulants during the session – the kind used in top-level live brainstorming sessions, but designed specifically for brainlining.

The most important feature of brainlining is cross-pollination. Brainlining sessions increase in effectiveness to the degree that they enlist people of divergent interests and expertise.

General rules

- 1 The Moderator is in charge; one has to follow the Moderator's directions.
- 2 Only the Moderator types in ALL CAPITALS and only when giving directions.
- 3 The games are played with intensity, mutual support and fun.

Alphabet soup game

- 1 The Moderator states the problem and announces a letter of the alphabet.
- 2 All Brainliners make suggestions using the given letter.
- 3 Play continues until the Moderator gives a new letter or stops the game.

Example (hypothetical illustration)

Moderator: HOW DO WE GET MORE PEOPLE TO BRAINLINE? THE LETTER IS 'M'.

Jazz: Do it to *music*.

Classic: Offer *more* free time on the Net.

Pop: Stress the *magic* of it.

Rock: Show them it is a way of *meeting* people.

Jazz: *Magnify* their need to join.

Rock the boat game

- 1 Moderator announces the problem and makes a Suggestion.
- 2 Any Brainliner makes an Opposing Suggestion.
- 3 All Brainliners pitch in with Opposing Suggestions and continue until the Moderator calls a stop to the game.

Example

Moderator: HOW DO WE MAKE SURE WE ARE NEVER LATE FOR APPOINTMENTS?

Make sure we don't go to meetings.

Jazz: Make sure we always go to meetings – early.

Rock: Make sure meetings don't start before we arrive.

Classic: Ask for meetings to be held up until we can attend.

Hot potato game

- 1 Moderator announces the problem, makes a Suggestion and names a Brainliner.
- 2 The Brainliner named builds on the Moderator's Suggestion, names another Brainliner, and continues to build and name.
- 3 Moderator and all named Brainliners continue to build and name other members until the Moderator calls a stop to the game.

Example

Moderator: HOW DO WE MAKE MONEY ON THE STOCK MARKET? ANALYSE MARKET TREND. JAZZ.

Jazz: Predict future trends. Rock.

Rock: Only for shares that have upward trends at current time. Moderator.

Moderator: Get information from experts. Classic.

Classic: Find out who are the experts. Pop.

Pop: Approach a financial consultant. Jazz.

QUESTIONS

- 1 What advantages and disadvantages do the different variants of brainstorming have in comparison to conventional brainstorming?
- 2 A department is experiencing problems with getting some of its members to participate fully in departmental activities. How might brainstorming be used to come up with possible solutions to such a problem? Illustrate your answer.
- 3 Show how you might use the Gordon–Little variation to redefine a problem of your choice.
- 4 Suggest ideas of your own about how brainlining might be developed.

CASES

Reducing wear and tear

The problem has been defined as how to compensate for the fact that vehicles tend to travel in each other's 'tracks' and cause excessive wear at certain points on the surface of a motorway.

Question

Suggested solutions to this problem (see Appendix 2).

Inefficient office juniors

Most departments in the firm always employ an office junior to help with the routine chores of the office. The firm feels that it is showing a degree of social responsibility by providing employment for people who might otherwise be unemployed. At the same time it reckons that it is also providing on-the-job training for people so that they can gain experience and take on more responsible jobs in due course. Office juniors are usually school-leavers, although occasionally older staff are appointed to such positions; juniors can be of either sex.

The office junior has the lowest status of any white-collar job in the business and is generally poorly paid. Incumbents of these positions are at the beck and call of all members of a department and are generally treated as skivvies or messengers. They seldom have the opportunity to develop skills that will enable them to progress to more responsible posts in the organization.

Generally, office juniors are treated as being something of a nuisance by their colleagues. There is a feeling that one has to give them something to do otherwise they will become bored and hang about the office and cause minor disruptions to the important work that is being undertaken. Moreover, as one person in the accounts department put it: 'You have to give them something to do to keep them out of trouble. But if you give them something to do they will probably get it wrong and you will have to do it all over again. It is best to give them things to do that they cannot possibly get wrong. This usually amounts to running errands for you.'

It is not surprising, therefore, that there is a high turnover in office juniors. If an office junior stays for more than a couple of months, that is considered to be good going.

Question

Use brainstorming or one of its variants to come up with ways in which this problem might be resolved.

Sorting out acquisitions

A large company has grown to its present size through a series of acquisitions. This has enabled the firm to diversify considerably from its initial product-market scope. So far the procedure following an acquisition has been to leave the acquired firm still in the hands of the previous managers and simply treat it as a subsidiary of the main firm.

These subsidiaries have their own board of directors and have unfettered power with respect to policy making. The main company, however, does own the majority of the shares in them and therefore has effective control via the medium of voting power at shareholder meetings.

Recently, some subsidiaries have shown inefficiency in setting their marketing policies, with the result that loss of market share and fall in profitability have ensued. In addition, there has been some degree of cannibalization taking place as a result of some of the subsidiaries, whose product-market scope is not too different from one another, putting new products into the market that compete with one another in the same market segments. Then there is, of course, the not unusual problem of duplication of facilities offered by the subsidiary companies.

Question

What options might the main company pursue to resolve all the identified difficulties? What other difficulties do you think there are? Use brainstorming or one of its variants to come up with some ideas.

Coolers

The Coolers company produces home refrigerators and has successfully marketed these products for a period of ten years. In recent years, however, the refrigerator business has become more and more competitive, with new entrants from abroad making sizeable inroads into the market. Not only has Coolers' market share been substantially eroded, but its return on capital employed has also begun to slide downwards. Its pre-tax return fell from an all-time high of 27 per cent just over three years ago to 18 per cent in the last financial year.

Some of the competitors have patented improvements to refrigerator design that the company cannot duplicate. The firm has not tried to reposition its products in the minds of customers; but, even if it did, it feels that it might be difficult (though not impossible, of course) to do so. However, the firm does not know which direction repositioning might take or what the consequences of such action might be. It is becoming more and more difficult to get business, and there is considerable under-utilized capacity in the industry at home.

The company is considering diversifying its product-market scope through acquisition or some form of strategic alliance. In the course of considering this line of action, the following questions have become apparent:

- What business is the firm really in?
- What customer wants and needs are really being met by the firm?
- How are the current trends in the marketplace likely to influence the developments of the markets in which the firm is currently operating?
- What products are likely to be required by customers in the markets currently served by the firm?
- What other product-market opportunities exist?
- What products should the firm seek to add to its product lines?

Question

How can brainstorming techniques help in this case? Use brainstorming or one of its variants to come up with some ideas on how to solve some of the above problems.

Computers Incorporated

The chief executive of Computers Incorporated believes that there must be a market for portable personal computers that are used on the move in remote locations for long periods of time.

'There are many itinerant professionals and similar people who travel all over the world, operate in remote regions and need a portable computer to help them with their work,' he says.

Most of the executives in the firm agree with this point of view; but, as the technical director points out, computers need power, and batteries have limited capacity and need frequent recharging. As long as there is an electricity supply close by, there is no problem. However, travellers in remote regions often do not have access to such power.

The company feels that this is a problem which requires further investigation and decides to:

- (a) try to establish the true extent of the potential demand for a suitable product;
- (b) come up with some ideas for providing a technical solution to the problem of powering portable computers under such operating conditions.

Question

Use brainstorming or one of its variants to come up with solutions to problem (b) above.

More quality from work?

Management was concerned about work performance on the shop-floor. Output was down on previous years, and there were more rejects than ever on the production line. The operations manager decided to hold a brainstorming session with the foremen. The following summarizes what took place.

PROBLEM AS GIVEN: Employee output down and more rejects on production line.

PROBLEM RESTATEMENTS: How to . . .

- 1 increase performance levels
- 2 get a better trained workforce
- 3 improve work quality
- 4 make employees work harder
- 5 motivate workers to higher performance
- 6 reward good performance
- 7 improve working environment
- 8 achieve job enrichment
- 9 get hold of improved machinery
- 10 encourage workers to work longer hours

Restatement 5 was taken as the basis for idea generation, and the following ideas were illustrative of those produced:

- 1 increase wages
- 2 vary job routines
- 3 provide on-the-job training
- 4 improve housekeeping
- 5 give workers more responsibility
- 6 better incentives
- 7 performance-related pay
- 8 give feedback on individual or group performance
- 9 competitions

A couple of wild ideas were thrown into the session as well:

- 1 eliminate the need for work
- 2 offer employees millions of pounds as an incentive

Questions

- 1 What use, if any, could the above ideas be in helping to solve the problem?
 - 2 Can you build on the ideas produced in any way so as to improve them?
 - 3 Try using some of the other problem restatements to produce insights into the problem.
-

Thoughts on back-stabbing

‘Why aren’t there more murders in business?’ John asked.

There was silence in the room.

‘I mean, everybody has it in for someone at some time in their life, and there is a lot of metaphorical “back-stabbing” going on in most organizations. I am sure the thought of committing murder must go through many people’s minds.’

‘Are you being serious?’ Sally asked, looking up from her work and resting her pen on the end of her nose.

‘Of course,’ John replied. ‘And, anyway, most crimes are never solved – or do not even come to light. So perhaps there are lots of murders taking place every day in the business world.’

‘Oh, don’t be absurd!’ Jayne interjected. ‘You really do have the weirdest ideas.’

‘Well, what do you think people do about people they can’t deal with?’ John asked.

‘I really have never had time to consider it,’ Jayne retorted. ‘I know people get pretty angry with one another at work sometimes, but never enough to want to murder one another.’

‘So what do they do?’ John asked.

‘They keep quiet about it, for one thing,’ Sally interjected impatiently.

‘Yes, perhaps they do,’ said John thoughtfully.

Question

Imagine someone was creating a lot of problems for you at work. Perhaps they saw you as a threat to their own prospects for advancement in the organization. How would you deal with threats of this nature? (Hint: brainstorm the kinds of problem that they might create for you. Next brainstorm how you might deal with such problems.)

FURTHER READING

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Lateral thinking and associated methods

A way of stretching the imagination

Some problems seem to be very difficult to solve; no matter how long we spend using brainstorming methods we simply access our existing paradigms, and these somehow do not seem to produce the desired insights into the problem. We are left with the feeling that the paradigm almost produces a solution, and if only we could stretch it just a little bit more, then we might find a viable solution. Take, for instance, the case of shoe fasteners. First there were buttoned shoes, then laced shoes and then slip-on shoes using just elastic. Each of the fastening methods was an improvement on the previous one in some way; but, of course, each one had its own problems and limitations, too. Then someone hit on the idea of extending the velcro fastening method to shoes. This involved stretching existing paradigms to cover a new application. There are many techniques which can help us to stretch existing paradigms, and some of these we consider in this chapter. They involve challenging assumptions, looking for analogous situations and trying to apply ideas that seem to have worked in one situation or another. Metaphors and similes can assist in the process.

INTRODUCTION

The chapter intersperses a variety of additional mechanisms suggested by various writers with the main ideas expressed by de Bono about lateral thinking. Lateral thinking can be categorized under the headings of awareness, alternatives and provocative methods. The chapter considers each of these aspects of lateral thinking in turn. Lateral thinking does advocate some ideation methods, and these come under the heading of provocative techniques. They include random stimulus, intermediate impossible, reversals, distortion and exaggeration, exposure, cross-fertilization, problem switching and the use of the term *po*. An introduction to thinking in terms of metaphors and analogies is also presented as well as thoughts about the discontinuity principle. Lateral thinking covers a wide variety of ways of thinking and approaching problems. Some of these approaches are suitable for paradigm stretching problems while others may be more appropriate for paradigm preserving. The use of metaphors and analogies are more likely

to appeal to divergent thinkers and occasionally they may even lead to paradigm breaking discoveries.

Edward de Bono coined the term ‘lateral thinking’ and has been actively promoting it for the past thirty years.¹ Essentially, lateral thinking is not just one technique but a number of different ways of opening oneself to creative thinking and problem solving. On closer examination it will be seen that lateral thinking has many overlaps with synectics (see Chapter 9) and several other well-known methods. Edward de Bono has written extensively about the process of lateral thinking – the generation of novel solutions to problems. The point of lateral thinking is that many problems require a different perspective to be taken in order to solve them successfully.

The chapter intersperses a variety of additional mechanisms suggested by various writers with the main ideas expressed by de Bono about lateral thinking. Lateral thinking can be categorized under the headings of *awareness*, *alternatives* and *provocative methods*. The chapter considers each of these aspects of lateral thinking in turn.

Awareness concerns the way in which people look at a problem; under this heading we review such things as *dominant ideas*, *tethering factors*, *polarizing tendencies*, *boundaries put around problems* and *assumptions*. With respect to the last of these we also look at a number of techniques to help us get to grips with the assumptions we hold. We consider *assumption smashing*, *challenging assumptions* and *assumption reversal*.

Alternatives refers to alternative ways of viewing a problem, and we look at such things as avoidance devices, rotation of attention, change of entry point, quota of alternatives, concept challenge, keyword omission and fractionalization and bridging.

Lateral thinking does advocate some ideation methods, and these come under the heading of provocative techniques. They include *random stimulus*, *intermediate impossible*, *reversals*, *distortion and exaggeration*, *exposure*, *cross-fertilization*, *problem switching*, and the use of the term *po*, an introduction to thinking in terms of metaphors and analogies is also presented as well as thoughts about the *discontinuity principle*.

OVERVIEW

Lateral thinking is about moving sideways when working on a problem to try different perceptions, different concepts and different points of entry. The term covers a variety of methods, including provocations to get us out of the usual line of thought. Lateral thinking is cutting across patterns in a self-organizing system, and has very much to do with perception. The term ‘lateral thinking’ can be used in two senses:

- *Specific*: a set of systematic techniques used for changing concepts and perceptions, and generating new ones.
- *General*: exploring multiple possibilities and approaches instead of pursuing a single approach.

¹ For an appreciation of the contributions of Edward de Bono see ‘Thinking outside the box Edward de Bono’s lateral thinking’, Sandra Dingli in Tudor Rickards, Mark A. Runco and Susan Moger (eds), *The Routledge Companion to Creativity*, Routledge, Oxon: Abingdon, 2009, pp 338–350.

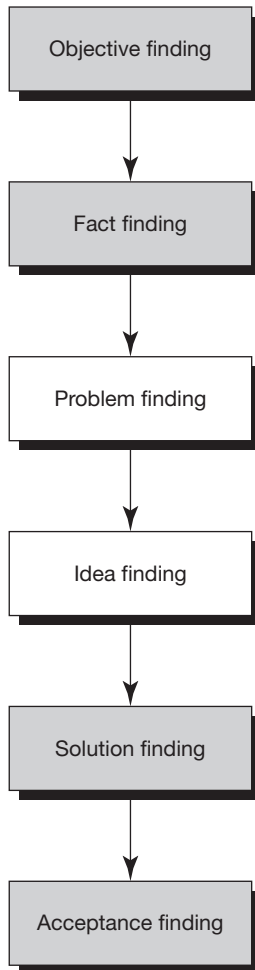


Figure 9.1

Position of this chapter within the CPS process

Lateral thinking is a way of thinking that requires people to look at things in an unconventional manner and requires them to be aware of the limitations of their normal frame of reference. For example, the assumptions people make are not always justifiable under given circumstances, and there is a tendency to view situations as having either this solution or that solution, with no other alternatives. Lateral thinking also demands that we should be aware of the other ways in which a situation can be viewed.

De Bono identifies four critical factors associated with lateral thinking:

- 1 recognizing the dominant ideas that polarize perception of a problem;
- 2 searching for different ways of looking at things;

- 3 relaxation of rigid control of thinking;
- 4 use of chance to encourage other ideas (this last factor has to do with the fact that lateral thinking involves low-probability ideas which are unlikely to occur in the normal course of events).

Lateral and vertical thinking

Differences between lateral and vertical thinking:

- Vertical thinking is selective; lateral thinking is generative.
- Vertical thinking is analytical; lateral thinking is provocative.
- Vertical thinking is sequential; lateral thinking can make jumps.
- With vertical thinking one has to be correct at every step; with lateral thinking one does not have to be.
- With vertical thinking categories, classifications and labels are fixed; with lateral thinking they are not.
- Vertical thinking follows the most likely paths; lateral thinking explores the least likely.
- Vertical thinking is a finite process; lateral thinking is a probabilistic one.

De Bono ([1970] 1971) envisages lateral thinking as a description of a mental process leading to new insights. For him the twin aspects of lateral thinking are, first, the provocative use of information and, second, the challenge to accepted concepts. Lateral thinking involves viewing problems from a new perspective in order to create more innovative solutions and move away from conventional ideas. In contrast to logical or vertical thinking there are no paradigms to follow. Vertical thinking involves continuity, whereas one of the characteristic features of lateral thinking is discontinuity.

In general, people are predisposed to vertical thinking, therefore the transition towards illogical thought patterns does not come naturally. However, the skill can be developed, and by looking at a problem from different perspectives new ideas can be generated rather than just variations on old ideas. The new ideas may well seem impractical in the first place, but if explored further a viable solution can often be found.

Three major activities go into making up lateral thinking:

- 1 Awareness
- 2 Alternatives
- 3 Provocative methods

AWARENESS

Here the concern is to redefine and clarify current ideas. It is argued that, before old ideas can be discarded or new ones adopted, current ones must be fully appreciated in terms of their good points and limitations. Current ideas can be examined from five different perspectives (Figure 9.2).

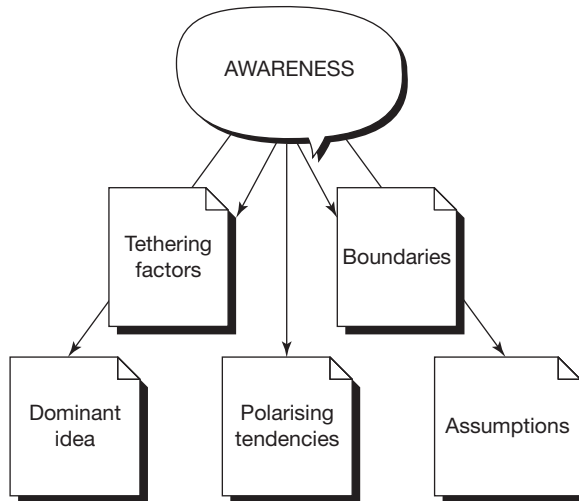


Figure 9.2
Perspectives

Dominant idea

Whether we like it or not, we are likely to have predispositions or dominant thoughts and ideas about a problem when we first approach it. We have to take steps to recognize the dominant ideas in our mind so as not to limit the scope of the kind of solutions to the problem which we will entertain. This is in line with the suggestions of Rogers and Kelly as indicated in the opening paragraphs of Chapter 1. Knowing oneself and one's biases, attitudes, values and expectations is very important, for they influence one's perception of problems and the factors relating to them.

For instance, if we are looking at why the firm's products are not as profitable as they might be, and the dominant idea in our mind is cost, then it is quite possible that we may overlook or pay insufficient attention to the other factors that influence profitability. Encouraging other people to give us their perspectives on a problem can be extremely helpful, for they may see

PUZZLE 9.1

Relative assumptions

- Four women each have three daughters.
- They are celebrating one of the daughter's birthday around a large dining table.
- There are thirteen chairs around the table.
- All four women and their daughters are seated around the table.

Question: How is this possible?

things as being important which we have marginalized in our own mind. The *dominant idea* bias is similar to *mindset* explored in Chapter 2 and also to *perceptual blocks*, which were discussed in the same chapter.

Example

Imagine for a moment that your male boss has sent around a message saying that he has noticed that people are coming in late from the lunch-break and that he assumes that it is because they are doing their personal shopping. How would you react? Depending upon whether you are male/female, married/single, old/young, have a family/have no family may very well influence your immediate response to such a communication.

Tethering factors

Tethering factors are really assumptions – that is, factors that are assumed to be included in the problem and which are overlooked. If the fire alarm sounds from time to time, and we come to learn that it is just a false alarm or simply random testing of the alarm, we come to believe that this is always the case. When a real emergency occurs we may not respond as quickly as we should to the alarm. We need to be very much aware of these tethering factors so that we are not caught out because of them.

Example

Workers have threatened to strike over a job demarcation issue. There has been no history of strikes in the factory, so management acts in accordance with the principle that the workers are bluffing. This is a tethering factor, for the workers may well come out on strike – we cannot assume that what has occurred in the past will as a matter of certainty continue into the future.

Polarizing tendencies

This is reflected in an ‘either/or’ situation. Emotions may run high when a problem arises that involves the contrasting perspectives of individuals or groups of people. The emotions may lead to a polarizing situation where neither party wants to step down from the way in which it views matters. Such a situation, of course, vastly reduces the number of possible solutions to such problems. Compromise is the order of the day.

Example

Trains are invariably held up for one reason or another. If passengers have to ‘like it or lump it’, they develop very unfavourable attitudes to the providers of the rail service and eventually may find alternative means of travel. This means lost custom as far as the railway company is concerned. By providing compensation to customers when trains are late or cancelled the railway company creates good will; and, although the customer may be disgruntled, he or she will not be put off entirely from travelling with the railway company in future.

Boundaries

The boundaries we put around a problem limit the amount of space that is available to solve it. Some problems may not be capable of solution unless we look beyond the currently defined boundaries. At the very best the solutions put forward may only be variations on old ideas, and these may not function too well. If we think of the late nineteenth- and early twentieth-century writers such as H. G. Wells, while their ideas concerning space travel are now a reality, it was not something that could have been achieved with the technology at the time the works were written. It required the pushing back of the boundaries of science and technology for more than half a century before it was possible to do what Wells envisaged. Indeed, if we look at the work of more recent science fiction authors, we are still a long way from realizing the fantasies that they propose.

De Bono suggests the technique of the *intermediate impossible* as a mechanism that can help us to go beyond the boundaries of a problem. This is discussed later in the chapter in the section on *provocative methods*.

ASSUMPTIONS

We have already given attention to assumptions under the heading of *tethering factors*. However, it is important to repeat it here. All ideas relating to the solution of a problem make use of assumptions. We need to be aware of the assumptions we are making when we are looking for solutions to problems since the assumptions will limit the number of possible solutions that we can consider. If we assume, for example, that, while wood will float on water, metals such as iron and steel will not float on water under any circumstances, we might naturally only think of building sea-going vessels out of wood and not out of metal. New insights into problems can often be made by challenging basic assumptions. There are several techniques that can help us to do this.

Assumption smashing

A useful technique for generating ideas is to list the assumptions of the problem, and then explore what happens as you drop each of these assumptions individually or in combination.

Example

When customers purchase software, they are encouraged to purchase support agreements for a cost of 15 per cent of the software value. The revenue from this maintenance funds the support personnel who answer telephones.

The assumptions of this situation are:

- Customers purchase maintenance agreements.
- Customers pay 15 per cent of the software's worth for support.
- Support is a product and should therefore be sold.
- The software vendor provides helpful, timely support.

Now think about the situations as each attribute is dropped.

- 1 What happens if support is free? Maybe the software price should be increased and the support given away, creating the impression of free support.
- 2 Don't offer support. The vendor doesn't have to support it, so doesn't have to employ support staff.
- 3 If anyone rings for help, put the person off! This could lead to customers forming their own support groups (user groups) or turning to other areas such as the Internet, bulletin boards, newsletters, independent support specialists, and so on.

Assumption reversal

Not only can you drop or smash assumptions but you can also reverse them (Grossman, 1984). Where something involves a logical paradox this method may be appropriate. Doing more with less is a logical paradox. The method involves:

- 1 listing all the major assumptions about the problem, including the obvious
- 2 reversing each assumption in any way you want – anything goes
- 3 using the reversals as stimuli to generate new ideas

Example

Suppose you are keeper of a museum containing a wide variety of everyday domestic and personal artefacts in use from the fifteenth century to the present day. One of the problems you encounter is having enough exhibits to show people and having enough variety to change the exhibits from time to time in order to get people to visit the museum more frequently. In addition, you have less money to spend on the acquisition of such artefacts than you had the previous year.

First you list all the major assumptions. One of these assumptions might be that museums buy artefacts for everyone to see. Reversing this assumption leads to the statement that museums don't buy artefacts for everyone to see. This statement then might be used as a stimulus to suggest a museum is a place to which people bring their own artefacts to be displayed free of charge and for a limited period – i.e. they are loaned for a fixed period of time and then subsequently a new set of loaned objects are displayed.

ALTERNATIVES

This is concerned with searching for as many different ways of looking at a problem as possible. Different perspectives provide different insights into the problem. There are a variety of approaches, as is indicated in Figure 9.3.

Avoidance devices

Avoidance devices consist of developing a frame of mind in which one tends to ignore old ideas and be open to new ways of looking at things. The essence of this approach is summarized in the well-known saying 'Prevention is better than cure'.

CHALLENGING ASSUMPTIONS: WHAT CAN WE TAKE FOR GRANTED?

A well-known international firm started losing money for the first time in many years. A new chief executive took over the running of the company and set about trying to remedy the situation. He had learned in the past that good control over costs could reverse the fortunes of an ailing firm. His main assumptions were:

- 1 If it seemed cheaper to buy components than to produce them, the firm should buy them.
- 2 Making a resource work more is synonymous with more effective utilization and hence should improve profitability.
- 3 Inventory should always be viewed as an asset.
- 4 Product cost is the main base for determining selling price.

His first job was get cost estimates for each of the many thousands of parts made by the firm, along with the alternative cost of buying them. Every part that cost more to produce than to buy from outside was then outsourced. This was done, and the result was that total costs increased.

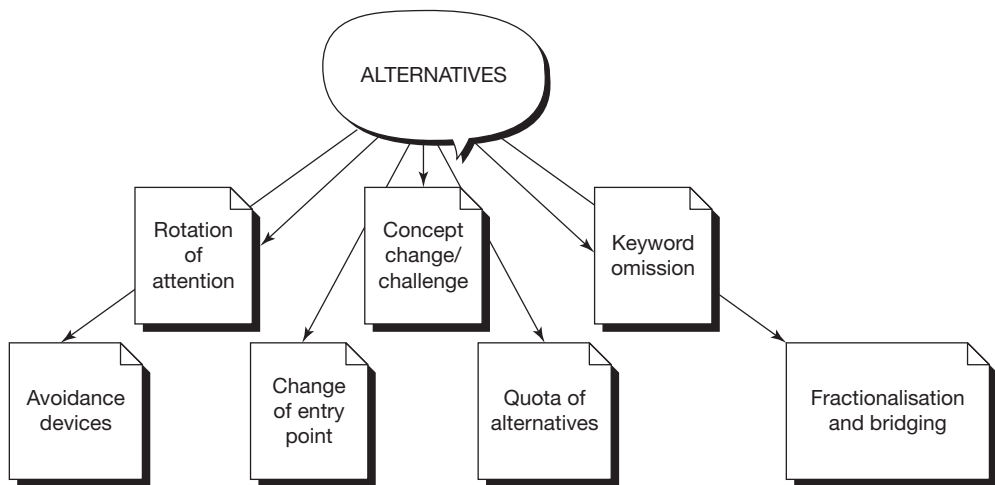
A further review of the situation showed that many more parts could now be bought from outside more cheaply than they could be produced. So the decision was then made to outsource all component parts and not to produce any parts at all.

The financial results still proved to be poor, so the chief executive decided to look at the operation of the assembly plants. He found that plants were only operating five days a week and for two shifts. His next ploy was to get them to operate for seven days a week and for three shifts, thereby making full utilization of capacity. The result was that the inventory of stocks built up and the firm seemed to be making a larger net profit. After twelve months in the job he seemed to have turned around the ailing firm. The directors of the company were pleased with his performance, and he received a bonus. His very next step, however, was to resign and leave the company.

Questions

- 1 Can you explain why he left the company?
- 2 What do you think happened to the company's fortunes after he left the company?
 - (a) given a substantial increase in worldwide demand for the company's product?
 - (b) given no change in the current worldwide level of demand for the company's product?
 - (c) given an overall decrease in the worldwide demand for product?
- 3 Can you identify inadequacies in any of the assumptions that the chief executive may have made during his short stay with the company?

See Appendix 2 for suggestions.



■ **Figure 9.3**
Alternatives

Rotation of attention

Rotation of attention involves moving away from the core of the problem and shifting focus to the surrounding factors. It is natural to focus attention on the core of a problem, but this may not lead to creating new ideas. An example of rotation would be that, if the core of the problem seemed to be reducing manufacturing costs, another aspect of such a problem might relate to staffing costs or administrative costs.

Change of entry point

The *change of entry point* is a method which entails identifying the starting-point for viewing the problem. People think in sequence, therefore by changing the point at which that sequence is started different outcomes can be achieved. For example, the problem may concern improving the viewing figures for a television network. Initially, the problem might be redefined in terms of there being insufficient funds invested in its programmes. Another starting-point, however, would be to consider a more effective way of scheduling its programmes.

Quota of alternatives

Setting a *quota of alternatives* involves keeping only a few decidedly different options for consideration. This makes it easier to distinguish between ideas that may have too much in common and make it difficult to appreciate their fundamental differences.

Concept changing and challenging

Concept changing aims to prevent a problem being viewed from a fixed point. A barge, for example, might equally be considered as a mobile home or a holiday vehicle.

Concept challenging involves considering in depth any important statement usually taken for granted and challenging it in all ways possible. This assists with suspension of judgement and helps one to escape from habitual thinking patterns.

Example

The problem might be one of trying to find ways of reducing the need for telephone calls. The statement might be:

'Maintaining communication with business contacts without the aid of a telephone is impossible.'

The idea is to think of ways of communicating with business contacts without the aid of a telephone.

Challenging a concept usually taken for granted can lead to questions such as 'Why does a product have to have certain properties or be made of a certain material, or be formed in a particular shape? For example, why do cars have to have doors on each side?' Another concept challenge might be 'Why does a company need a marketing manager?'

Keyword omission

Keyword omission enables fresh ideas to be generated. In examining ways to improve productivity, wages and salaries may be dropped from a discussion and other terms may be used in their place – for example, payments to employees or work service payments. This may lead to ideas on how to increase job satisfaction and therefore get more productive work from employees for the same wage.

Fractionation and bridging divisions

Fractionation and *bridging divisions* are two opposite concepts. The former involves separating a problem into its parts without any regard to logical subdivisions, while the latter involves bringing the parts of a problem together. For example, a problem may be seen as how to increase attendance at meetings. The problem may have arisen because people often have other commitments and do not always feel that the contents of the meetings are of particular value or interest to themselves. The problem may be subdivided into scheduling meetings so that they are convenient for people to attend and providing some motivation for people to attend. *Bridging divisions* causes the problem to be redefined as to how to schedule meetings so that they will be of interest to the most appropriate people.

PROVOCATIVE METHODS

In order to gain insights into a problem, de Bono advocates the use of a number of ideation techniques. These, along with a number of associated techniques, are discussed below.

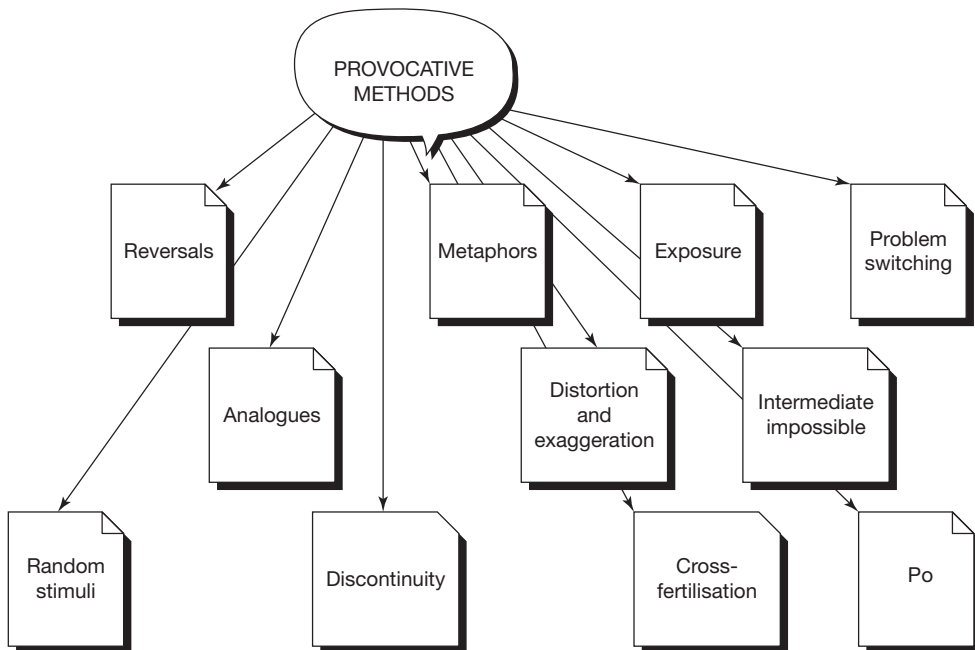


Figure 9.4
Provocative methods

Random stimulus

Random stimulus suggests that one should sample any rich set of random stimuli and seek a relationship between the object and the problem under consideration. De Bono argues that this restructures perceptions away from preferred patterns and enriches the content of the solution set.

Example

Imagine a position where two key members of the office are leaving at the same time and suddenly resources are very depleted. The random stimulus might be a 'ball'. How can we relate the concept of a 'ball' to the problem? Well, of course, the word 'ball' can be a ball as used in a game of cricket or football or it could conceivably be a gathering associated with a dance. The latter might lead on to the idea of having a 'party' to which lots of friends and acquaintances from other offices are invited. At such a gathering a temporary solution to the problem might well be found. There may well be suitably qualified and experienced people who can help out with the work for a while until suitable replacements can be found.

Random word interjection in problem solving brings about a *discontinuity* – that is, a change that does not arise as part of the natural development of the situation. The method involves trying to link a randomly generated word to the problem in some way. For example, the problem may be how to increase profits or sales and the random word chosen may be ‘snooker’. Ideas may then be generated about aiming for pockets and achieving targets, not getting snookered into one position, scoring points with customers, taking the correct marketing angle, and so on.

Example

Assume that in a toy company there is absenteeism from the workplace. The problem is how to reduce it. The process starts by taking a random word. Suppose that it is the word ‘butterfly’.

The properties of a butterfly are listed:

- starts as a caterpillar then blossoms only lives for a short while
- is very pretty to look at
- is therapeutic to watch
- has wings

From these, a number of interpretations can be made:

- starts as a caterpillar then blossoms

This could show that the method implemented may commence slowly and that people may resist the changes. However, the company should persist with the plans as they will come together in the end.

- only lives for a short while

Can be compared to the staff interest level. How do we improve the interest levels of the staff so that they do not get bored or lose interest?

- very pretty
- therapeutic

We have to improve the working environment – people are more relaxed and comfortable in a pleasant working area. We need to make them feel that they are not actually going to work. If most people are feeling happy and seem to be enjoying work, then it may make the remainder follow suit.

How can we create a friendly fun atmosphere to avoid sickness due to stress or dullness? This might be done through group activities.

- has wings

Wings are flexible; adopt flexible working practices. Or again the use of ‘butterfly’ with another problem: how to get people to attend meetings.

- short-lived
- flutter around from place to place
- caterpillar – chrysalis – butterfly

Make meetings as short as possible.

- flutter around from place to place

Consider different venues for meetings.

- caterpillar – chrysalis – butterfly

Consider multilevel meetings – meetings at which all the same people need not attend.

Example

How to ensure people adopt a new system of working. Randomly selected object: video-recorder (the first column in the list below gives the 'property' of the video-recorder; the second, the implication of the property with regard to the solution of the problem).

<i>Record:</i>	Establish a means of monitoring how well the new system is working.
<i>Fast forward:</i>	Provide training in stages to allow some to progress at faster speeds than others.
<i>Rewind:</i>	Additional training or refresher training for those who need it.
<i>Timer:</i>	Automatic monitoring devices to identify additional training needs.
<i>Change channels:</i>	Ensure that old and new systems run concurrently, initially to prevent total system collapse if the new one fails or has too many hiccups.
<i>Remote control:</i>	Make sure that all concerned <i>are</i> involved in the training process and no one is considered to be too remote from the system for inclusion in the programme.

Intermediate impossible

The nine dots problem (Figure 9.5) has much in common with the concept of the *intermediate impossible*. In the figure you have to connect all the dots with four straight lines – and without taking your pen off the paper (see Appendix 2).

Intermediate impossible is associated with the idea expressed in lateral thinking that one should go beyond the traditional boundaries of a problem or situation if one is to find new insights into that problem. The technique involves thinking up an ideal but impossible solution to a problem and adapting it to make it a viable option. For example, the problem may be how to improve food in the canteen, the ideal solution to which may be to hire a top television chef; this may lead to the possible solution of sending the problem current chef on a training course.

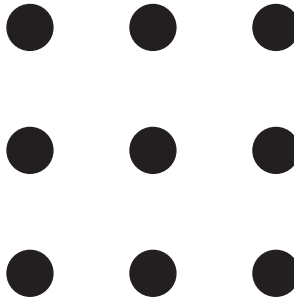


Figure 9.5

The nine dots problem

The process is as follows:

- 1 The problem is clearly stated.
- 2 Absurd or impossible solutions are welcomed and all are recorded.
- 3 One of the wild ideas is taken forward and is then broken down so that more practical solutions can be found.
- 4 If no practical or suitable solutions can be found, another of the absurd solutions can be chosen.

Example

How to stop sales staff from making personal calls using the company's telephones.

Impossible solutions:

- Record all outgoing calls.
- Remove all telephones from the office.
- Anyone who is spotted making a personal call is sacked.
- Hire detectives to work undercover in the office.
- Make staff pay for all calls made and give them their money back for confirmed business calls.

The idea of using detectives was selected for further development.

- Use an electronic private eye to monitor telephone activities.
- As above, but employ members of staff to spy on each other.

The company chose to introduce a system whereby any sales member who observed another abusing the company's trust could tip off the managers in confidence. They were encouraged to do this with rewards, and the culprit would be observed closely and further action taken.

Example

Returning to the 'reducing the need for telephone calls' problem we might suggest the impossible solution of shouting messages from the windows of the office instead of using the telephone.

This might lead to the idea of messages having to be delivered in person to people whose offices are not too far away, which in turn leads to the idea of messengers calling regularly on business clients who are based within a relatively small radius.

Example

How can we sell more televisions in slack periods of the year? Give them away.

This may suggest a buy-now-pay-later offer whereby the customer effectively gets the television free for a period of time before a payment is made.

Reversals

Reversals suggests that one should take a problem or a threat and seek various ways of refocusing so that the threat becomes an opportunity. The method:

- State the problem.
- Make the statement negative – for example, if you are dealing with customer service issues list all the ways you could make customer service bad.
- Doing what everybody else doesn't – for example, Apple Computers did what IBM didn't, Japan made small, fuel-efficient cars – something the Americans wouldn't consider at the time.

Example

Let us consider again the two members of staff who are leaving the office at the same time and leaving it somewhat depleted of resources. While this constitutes a threat to the smooth running of the office it also constitutes an opportunity to find other ways of dealing with the workload of the office. For instance, perhaps it is not replacement staff that are required but additional labour-saving devices in the form of office equipment.

Distortion and exaggeration

This involves taking the problem to extremes. If there are many faulty goods being returned, rather than investigating what is causing the faults, the method suggests that we should consider what we should do if *all* the goods were faulty. The solution would then be to redesign the product. The technique produces fairly radical solutions to problems.

Exposure

This is a technique which makes use of the force-fit method that we have encountered elsewhere in the book (see pp. 135–137). Laennec's idea for the stethoscope (see Chapter 1) and similarly obtained ideas fit in with the principle involved here. It is suggested that we should try to force-fit together a stimulus that might be observed in the outside world to the problem with which we are concerned.

REVERSAL

A large electronics distributor had 38 locations with about 1,300 employees, half of whom were sales people. The firm sold and packaged goods of over a hundred suppliers to meet the needs of over 30,000 customers. Until the early 1990s, it employed MBO-based compensation plans. It was very proud of its elaborate system of incentives for everyone in the firm. Then the CEO and other senior managers in the company were exposed to the ideas of a creativity consultant who pointed out the disadvantages of MBO. They began to realize that the MBO system they were so proud of was actually a barrier to innovation as it discouraged full cooperation between business team members and increased suboptimization.

Over a one-year period, the company eliminated all individual incentives, including sales commissions and all supplier-sponsored promotions. As a result, it set up an environment that has created a doubling in sales and earnings, a reduction in employee turnover of over 50 per cent and the achievement of an ISO 9002 certification in every warehouse and value-added operation in less than six months, without using outside consultants.

Cross-fertilization

Here stimulation for an idea is provided by people working in different jobs or having different skills. One simply invites someone who is an expert in their field to say how they would approach a problem on which one is working, using the skill and knowledge they have achieved in their own field.

Recent developments in microsurgery have involved controlling the movement of instruments via movement simulation on a computer screen. In this case expert players at virtual reality computer games might be able to provide some assistance to surgeons regarding how to control movements on the computer screen with the aid of computer-input devices such as joysticks, keyboards, mice, etc.

Problem switching

Insights that we gain from working on one problem may well give rise to new insights into another. The method advocates switching from one problem to another – or even interspersing problem solving with other activities – in the belief that this will enable new insights to be obtained. Interestingly, the method and the theory behind it have something in common with Graham Wallas's ideas about incubation.

Po

This is a symbol to indicate that the principles of lateral thinking should be applied. In the same way that *no* is used to reject an idea in the context of vertical thinking, *po* is used to indicate

PROBLEM SWITCHING

One of my students told me of the following experience he had undergone while thinking about a particular problem. A puzzle set by a friend stated that a 200lb man had to get across a long rope bridge with three bags of gold, each weighing 1lb. However, the bridge was beginning to collapse and would only hold a total of 202lb. The man only just had time to cross the bridge once, so how did he manage to get across the bridge with all the gold?

The student struggled with the problem for a while, trying to think of ways to get the gold across. First, he thought the man could throw the gold across, but the bridge was too long. Then he thought that the man could remove his shoes and go across, but he could not be sure that this would lead to an overall weight of less than 202lb. Another idea was to go halfway across the bridge with one of the bags, throw it the remainder of the way and then go back for the other bags.

However, as stated, the man only just had time to get across once. Finally, accepting defeat, the student said that the man would just have to settle for taking 2lb of the gold across.

The student then said that he forgot about the problem and went back to reading his book. While reading the book, he suddenly realized, completely out of the blue, that the man could get across the bridge if he could juggle the bags of gold as he walked. Doing this would mean that the man would only ever have two bags of gold in his hands at any one time. As the student pointed out to me, it showed him that by taking someone away from the problem at hand and undertaking a seemingly unrelated task it is possible to relax the mind and think in a more open manner.

that a new patterning system is to be introduced through discontinuity. The symbol *po* is often used in conjunction with the intermediate impossible. It indicates that one should not reject or accept an intermediate idea which is unacceptable, but that judgement should be suspended for the time being.

METAPHORICAL THINKING

A metaphor is a thinking technique connecting two different universes of meaning. Examples: food chain, flow of time, fiscal watchdog. The key to metaphorical thinking is similarity. The human mind tends to look for similarities.

In making use of metaphors in creative problem solving, one starts by stating the problem, then selecting a metaphor and finally using the metaphor to generate new ideas.

Example

PROBLEM: How might employees be encouraged to work more effectively to increase productivity?

METAPHOR: The human body is composed of different organs. For the whole body to function properly each organ must operate individually and all the organs together must work harmoniously. Some organs are more important for the human organism than others (e.g. heart, brain) and if they cease functioning for a long period the human body will die. Other inner parts of the body have relative importance. Blood flows through inner parts of the human body.

INTERPRETATION: An organization is made up of different departments. For an organization to work effectively, each of the departments must operate properly and all of the departments must work together harmoniously. Some departments are more important for the correct functioning of the organization than others (e.g. finance and marketing departments), and without their proper operation the survival of the business may be threatened. If something goes wrong in any of the departments, the whole company will be adversely affected. All must function smoothly for the smooth operation of the whole enterprise.

Cooperation between employees within the departments and between the departments is essential for the efficient operation of the whole business. This may be achieved by holding meetings at which departmental representatives can discuss departmental and interdepartmental problems. Communication is the lifeblood of the organization.

ANALOGY

The purpose of using analogies and metaphors is to raise sensitivity to a level that enables long-term common sense to prevail. Domestic situations are ideal – such as comparing cashflow to a plumbing system and staff development to gardening (Rogers, 1993).

The analogy is a statement of similarity between two different things. An example of one would be: 'The noises produced were like those of a cat on a hot tin roof.' In many situations the use of analogies facilitates new problem perspectives without which the solutions to problems may never be found. They provide the problem owner with a possible escape from 'mental stuckness'. In practice, analogous situations are examined and compared with the real problem to see if any new insights emerge. Suppose, for example, an organization wants to improve its productivity and chooses as its analogy the building up of a successful football team.

The football team analogy will be familiar to many people, and each stage of its development has an organizational equivalent that may raise questions that might otherwise be overlooked.

Forced analogy

Forced analogy is a very useful method of generating ideas. The idea is to compare the problem with something else that has little or nothing in common and gain new insights as a result. You can force a relationship between almost anything, and get new insights – companies and whales, management systems and telephone networks, or a relationship and a pencil. Forcing relationships is one of the most powerful ways to develop new insights and new solutions.

<i>Building a successful football team</i>	<i>Increasing productivity</i>
Bringing in good players	Recruiting experienced and well-qualified staff
Choosing the correct playing formation	Establishing efficient work groups
Having enough players to cope with injury problems	Having enough slack to cope with absenteeism. Train people to be multi-skilled
Striking the right pay deal	Performance-related pay
Creating team spirit and high morale	Developing the social side of work
A team that is well managed and coached, with a rigorous training system	Having an effective operations system and ensuring its smooth running

Figure 9.6
Analogy relating increasing productivity with building a successful football team

TASK: HOW TO ACHIEVE A SUCCESSFUL PRODUCT LAUNCH

Analogy – booking a holiday

- 1 Stipulate criteria (e.g. hot weather, beach, water sports, scenic, quiet).
- 2 Consult brochures and travel shops.
- 3 Consider budget.
- 4 Check availability.
- 5 Book holiday.

Interpretations could include:

- 1 Stipulate target market (e.g. geographic, demographic, psychographic, behavioural, etc.).
- 2 Look at previous product launches or consult specialist agencies, etc.
- 3 Consider the budget set aside for the product launch.
- 4 Check availability of media (e.g. air-time, poster space, print runs, etc.).
- 5 Commit to product launch, taking into account the above.

A useful way of developing the relationships is to have a selection of objects or cards with pictures to help you generate ideas. Choose an object or card at random and see what relationships you can force.

Example**Corporation as a matchbox:***Matchbox attributes*

- Striking surface on two sides
- Six sides
- Sliding centre section
- Made of cardboard

Corporation

- The protection an organization needs against strikes
- Six essential organizational divisions
- The heart of the organization should be 'slidable' or flexible
- Inexpensive method of structure – disposable

THE DISCONTINUITY PRINCIPLE

The more you are used to something, the less stimulating it is for thinking. When you disrupt your thought patterns, those ideas that create the greatest stimulus to your thinking do so because they force you to make new connections in order to comprehend the situation. Roger von Oech calls this a 'Whack on the Side of the Head', and Edward de Bono coined a new word, *po*. This is a symbol to indicate that the principles of lateral thinking should be applied. In the same way that *no* is used to reject an idea in the context of vertical thinking, *po* (*provocative operation*) is used to indicate that a new patterning system is to be introduced through discontinuity. Programming interruptions into your day, changing working hours, getting to work a different way, listening to a different radio station, reading some magazines or books you wouldn't normally read, trying a different recipe, watching a TV programme or film you wouldn't normally watch are all examples of this. Provocative ideas are often stepping stones that get us thinking about other ideas. Putting ideas next to each other, such that their friction creates new thought-paths, is a technique that flourishes in the East but causes discomfort in Western thinking.

SIX THINKING HATS

The Six Thinking Hats method (de Bono, 1985) it is a way to 'try on' different viewpoints. This can be very useful as a planning activity. Below is an outline that explains how to incorporate a critical thinking activity into the planning process.

Thinking hats – how it works

This involves people working on a problem in a group and each member of the group adopting a different viewpoint or modes of thinking about the problem. A variety of hats are used to represent the different types of thinking as outlined below. These may be made or cut out of different coloured paper. Each hat is a different colour and represents a different type of thinking. The key is to have a visual that represents the different types of thinking. The group needs a facilitator or at least someone who can collect thoughts and ideas that are generated during ensuing discussions.

Procedure

- 1 The group of six has to be provided with six different thinking hats. The six styles of thinking should be written down on a sheet of paper or a card and should be placed on each group's table as a reference. Each group member should be asked to familiarize themselves with each type of thinking.
 - 2 Each one of the group should then select a hat or type of thinking. Having donned a hat (either literally or figuratively) they should then be asked to discuss the problem from the thinking viewpoint of the hat they have chosen.
 - 3 Hats may be exchanged during the session to facilitate role changes or thinking approaches of group members.
 - 4 Making use of what is contributed by group members one should then try to develop a solution for the problem.
-

QUESTIONS

- 1 Lateral thinking is more than a set of creative problem solving techniques. Discuss.
- 2 'Creative thinking is really analogical thinking.' To what extent would you agree or disagree with this statement? Explain.
- 3 Suggest how analogies might be used to help suggest ways of helping to improve time-keeping.
- 4 What is lateral thinking? Illustrate how it might be useful to executives trying to find ways of introducing improvements in organisational procedures into their companies.
- 5 '*Lateral thinking* is not just a set of techniques but a way of thinking.' Critically evaluate this statement.
- 6 Illustrate how lateral thinking might help managers find ways of introducing improvements in staff motivation in their companies.
- 7 'There is nothing original in lateral thinking. It is simply a synthesis of the contributions of a few of the many writers on the subject of creative problem solving.' To what extent would you agree or disagree with this statement? Explain your viewpoint.
- 8 Suggest some problems to which the technique of assumption reversal might be usefully applied.
- 9 A firm is looking for ways of improving productivity on the shopfloor. Suggest how it might be done, using each of the following as an aid to creative thinking:
 - (a) a metaphor
 - (b) an analogy
 - (c) a forced analogy
- 10 Use the *intermediate impossible* technique to find ways of preventing shoplifting in a large department store.
- 11 Use the random word technique to find ways of improving interdepartmental communications.

- 12 Show how the 'keyword omission' method can help to find a possible solution to the problem of absenteeism in the workplace.
- 13 An airline wants to improve its profitability. How can *fractionalisation* and *bridging divisions* be used to good effect in helping to solve such a problem?
- 14 How does the Six Thinking Hats approach aid assist in the process of creative problem solving?

CASES

Business books

Edwina Publishers were looking for ways of ensuring the successful launch of a new series of business books. 'What is required', said John, 'is a new approach. There are so many titles and series in the marketplace nowadays that readers, students and lecturers have too much choice and cannot easily make their mind up which books best suit their purposes. I think the choice process they must go through is a bit haphazard.'

Jane suggested that it might be more to do with how the product was launched, and the kind of budgeting and marketing operations that went into launching a product. 'Look here,' she said, 'let us approach the problem from a creative problem-solving perspective. A book I have recently looked at suggests that we might consider analogous situations when we are trying to get insights into a problem. It first suggests that we should define the problem. In this particular case I think that is fairly obvious – i.e. how to achieve a successful product launch. It goes on to suggest that we next look for an analogy for the problem. In this particular case, one such analogy might be 'booking a holiday'. It then suggests that we consider what is involved in working with the analogous problem. This might mean such things as:

- 1 Stipulate requirements (e.g. good weather, good beach, water sports, scenic, quiet, etc.).
- 2 Consult brochures and travel shops.
- 3 Consider budget.
- 4 Check availability.
- 5 Book holiday.

'Interpretations could include:

- 1 Stipulate target market (e.g. geographic, demographic, psychographic, behavioural, etc.).
- 2 Look at previous product launches or consult specialist agencies, etc.
- 3 Consider the budget set aside for the product launch.
- 4 Check availability of media (e.g. leaflets, direct mail shots, print runs, etc.).
- 5 Commit to product launch, taking into account the above.'

'Well,' said John, 'I think we do those kind of things already. However, I like the idea of using an analogy. It might be worth spending some time exploring the approach in more detail.'

Question

How might John and Jane develop the analogy approach in this instance? Provide illustrations. What do you see as the drawbacks, if any, to using this particular approach in this instance?

Finding out more about candidates for interview

‘Another one having a nervous breakdown,’ said Jenny, closing the file and putting it in the pending tray.

‘Yes, that’s the third one this month,’ Arnold replied, hardly stopping from his task of keying data into the database. ‘Something will have to be done about it.’

‘I think the application forms and interview procedures need a shake-up,’ said Sarah. ‘Interviewers are making too many wrong assumptions when they read the application forms and conduct the interviews.’

‘What do you mean?’ asked Jenny.

‘Well,’ replied Sarah, ‘do we really know whether application forms are filled in by the candidates themselves? Can we be sure that the work experience candidates say they have is really true? Are references provided by referees really valid in the context of a candidate’s application?’

‘Some people are also better at selling themselves,’ Arnold interjected. ‘They just give the right impression.’

‘Well,’ said Sarah, ‘perhaps we ought to write down all the assumptions we make about how people fill in application forms and all the assumptions we make when interviewing people.’

‘What then?’ Jenny asked.

Questions

List the various assumptions that short-listers might make about candidates for jobs when the latter are completing application forms. Do the same for assumptions made about interviewees by interviewers. How would you proceed to use this information to gain further insights into the problem? Illustrate your answer.

Rose

Using the random word technique to come up with ideas for getting customers to buy a new brand of perfume, the following list of associated words and phrases for a rose were obtained:

- petals
- perfume
- bright
- colourful
- stem
- fresh
- thorns

- needs room to grow
- needs good soil and plenty of sunshine and rain to grow
- attracts insects

Questions

- 1 Illustrate how the list of associations might be used to come up with insights into the problem.
 - 2 Suggest other associations for 'rose' and interpret these into insights into the problem.
 - 3 Take another word as the stimulus, list associations and generate insights into the problem.
 - 4 Compare and contrast the various insights that have been generated.
-

Cash problems

A company had to generate a certain amount of cash in order to settle various loans by specified dates. Unfortunately, the business plan that provided the cashflow was too optimistic, and the firm was in the unenviable position of being unable to generate the cash required to pay off the loans. Sales were falling well short of expectations and, although profit was on target, insufficient cashflow would be generated.

Questions

Illustrate how lateral thinking methods might help gain insights into this problem.

An inventive clerk

- Pricing is based on estimating the amount of square footage that has to be covered.
- Jonathan viewed the plans with some disdain. How on earth was he to work out the square footage associated with the painting of the structure? The shape of the structure was very complex and although the drawings were very precise in terms of the scale there were still considerable difficulties to overcome when estimating the areas of the shape of the structure.
- Jonathan had never received training in calculus and had no knowledge of polynomials so trying to solve the problem by mathematical means was beyond his experience!
- However, he was quite creative and had recently studied Lateral Thinking Methods so finding a solution to the problem was not completely beyond his capabilities. He sat and puzzled over the problem for some time, thumbed through his course notes and then suddenly hit upon a way of solving the problem.

Question

What do you think he did?

Female preferences

The university has been experiencing difficulty in attracting females to study engineering and science. Girls seem quite keen to study Arts subjects and Social Sciences at the university but less so anything that has a mathematical aspect to it. The university has decided to go on a recruitment drive to attract more students to its science and engineering courses and wonders what is the best way to set about this.

Traditionally, the university invites students to open days when potential new entrants can meet with departmental and faculty staff. It has highlighted this as a prime opportunity to engage with potential newcomers but feels that to date it is somehow not getting enough female potential students to attend the open days in the first instance.

The university wonders how one might best address this problem.

Question

How might a creative problem-solving technique help the university to gain some insights into how best to challenge this problem?

FURTHER READING

Serrat, O. (2010) *Wearing Six Thinking Hats*. Washington, DC: Asian Development Bank.

Sloane, P. (2003) *The Leader's Guide to Lateral Thinking Skills: Powerful Problem-solving Techniques to Ignite your Team's Potential*, London; Sterling, VA: Kogan Page.

Stephen A. Butler, (2010) Solving business problems using a lateral thinking approach, *Management Decision*, 48(1): 58–64.

Synectics

An excursion in the mind

Take a problem and question the person presenting the problem until all aspects of the problem are understood. No brainstorming or solution gathering occurs at this time. Second, get away from the problem entirely, take a mental holiday. Someone suggests a fantasy or place to go, mentally, emotionally or spiritually – e.g. the top of Mount Everest, a rock concert or rave, an imaginary tour through the valves of the heart. Get as far away from the original problem as possible. Everyone present contributes to the fantasy, and someone takes notes of the excursion or mental 'holiday'. Examine elements and aspects of the 'holiday' and use them as an analogy to the problem solution. Practise 'force fitting' the vacation analogy as a metaphoric solution to the problem. For instance, what clues can the top of Mount Everest give us about promoting a brand of vodka? Obvious! Use the pureness of the atmosphere to stress the purity and medicinal qualities of the vodka! Or show someone being reinvigorated by it after having climbed to the top of a high mountain.

Synectics facilitates the stretching of existing paradigms to facilitate the creation of new insights.

INTRODUCTION

The chapter looks at the subject of synectics. A method of using synectics is outlined and discussion given over to considering the various components that make up the synectics process. The chapter explains the four different types of analogies used and gives illustrations of each. The use of analogical thinking in synectics demands some degree of divergent thinkers and is therefore most likely to appeal to those who enjoy thinking in a divergent manner. Synectics facilitates paradigm stretching and can lead to the discovery of new paradigms. One needs to have a sound appreciation of the use of analogies in problem solving, as outlined in Chapter 3, to get the best out of this technique. Ensuring that the surface and deep structures of analogies used suit the problem in hand is important. Having a well-informed facilitator for the synectics session is of paramount importance.

Nolan (2003) identifies the origins of synectics with a group of inventors, who tape-recorded their meetings to research their creative process, and the resulting benefits and weaknesses. He argues that synectics today is a set of process tools that can be used successfully in a variety of situations, either in a specific sequence (as in the original invention model) or individually according to the needs of the situation. The result is a variety of meeting models and techniques for enhancing personal effectiveness.

SYNECTICS

Synectics is the most highly refined and universally applicable of all the creative problem-solving techniques. Like brainstorming, it is a complete problem-solving process and is particularly useful for problem identification and idea development. The main aim is to use two operational mechanisms to *make the strange seem familiar* and to *make the familiar strange* in

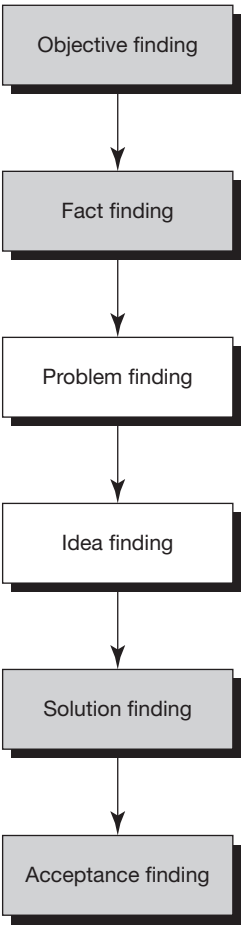


Figure 10.1
Position of this chapter within the CPS process

order to produce five psychological states that are necessary to achieve creative responses. These states are *involvement and detachment, deferment of premature solutions, speculation, autonomy of object and hedonic response*.

Synectics encourages the use of analogies to *make the familiar strange*: the personal, direct, symbolic and fantasy analogies. Synectics is perhaps the most difficult to perform of all the ideation techniques. Skill and experience need to be acquired before attempting to perform synectics. The origins of the technique are rooted in brainstorming. Synectics aims to open up a problem to new insights. It is the process of combining unrelated factors to allow problem solvers to view a problem from a different perspective.

Synectics was developed by William J. Gordon (see Gordon, 1961) as a result of research undertaken at the Arthur D. Little organization into creative individuals and the creative process. He associated the creative process with certain psychological states, believing that if these could be induced, then creative breakthroughs would increase their occurrence. He emphasized the need to make the familiar strange and vice versa:

To make the familiar strange is to distort, or transpose the everyday ways of looking and responding . . . it is the conscious attempt to achieve a new look at the same old world, people, ideas, feelings, and things.

(Gordon, 1961: 54)

This, he anticipated, would enable a problem to be viewed from different perspectives and thus support ideation based upon these various perspectives. Gordon encouraged the use of metaphors and analogies to aid the idea generation process. George Prince (who developed synectics, making it more efficient and productive – see Prince, 1970) joined William Gordon, and together they established Synectics Incorporated in Cambridge, Massachusetts, in the USA. In 1960, Gordon left the company, and he and Prince each developed their own version of the technique; the key difference between them is terminology. Synectics is a method for inventing new solutions to problems. No attempt is made to define the problem. The client's statement of the problem is taken as the starting-point; he or she gives a brief explanation of the background, as he or she sees it, and the group and client proceed to restate or paraphrase the problem in a language of 'how to' statements. These can be as speculative, unrealistic, wishful or challenging as the group feels inclined to produce. Their purpose is to open up the whole problem area and give the client an opportunity to get away from conventional ways of looking at the problem.

The synectics slogan – 'stay loose till rigour counts' – expresses a basic feature of the process. Rigour, precision, accuracy and realism are necessary and valuable in their place, but they are not the material of which creativity is made. We have to make a conscious effort to suspend normal acceptable intellectual standards if we are to give free rein to speculation, imagination and originality.

Conventional treatment of ideas makes two assumptions about the nature of ideas: first, that they are monolithic entities and, second, that their value is binary – good or bad. Our experience is that both these assumptions are incorrect and destructive. An idea is not monolithic; it has many facets. There is always something good about an idea.

A synectics group is made up of 6–8 people, plus a leader, and all the people in the group need to be trained in the use of the technique. Ideally, the group members should not be acquainted with the problem situation. No attempt is made by the problem owner to define the situation; however, ‘initial solutions’ held by the group members should be offered up in order that those that have not already been tried can be recorded as viewpoints. During the next stage, group members paraphrase the problem using ‘how to’, wishful thinking and fantasy statements. Having completed this, analogies and metaphors are used to take the group on an excursion. Ideas generated on an excursion, or if necessary in a series of them, are next related to the original problem in the hope of converting them to a practical application. Often expert guidance will be required to transform these ideas into final solutions.

There are various types of excursion that can be used, depending upon which the leader deems to be most suitable: personal analogy, direct analogy, symbolic analogy and fantasy analogy.

Personal analogy

Personal analogy is the use of emotions and feelings to identify an individual with the subject of a problem.

The problem may be how to vary a food product such as a fish finger. It may feel pain, be boring and may have a fishy odour which may not appeal to people. This may lead to some new element such as a tomato sauce filling being added to the product to negate the undesirable characteristics.

Personal analogy can involve:

- (a) describing the object by listing its basic characteristics and relating these to the problem
- (b) describing the emotions the object might have in a given situation
- (c) describing how someone feels when using the object
- (d) describing what it feels like to be the given object

Based upon such an approach, it might then be possible to develop solutions to the problem.

Example

Imagine that the problem is ‘how to market a bottle of wine’. The personal analogy could be to imagine what it feels like to be ‘the bottle of wine’. Some suggested feelings might be:

- ‘I feel wanted’
- ‘I feel important’

Alternatively, of course, we could consider the characteristics of the wine – clear, fruity, etc.; the emotions that the wine might have in given situations, etc. – happy at dinner, friendly at parties; or what one might feel like when using the wine – sophisticated, tired, etc.

We might then look at ways of how we could try to incorporate these feelings into the promotion of the product (or, where negative, compensate for them in our promotional messages). It is through such a technique that we are able to release ourselves from looking at a problem in terms of its previously analysed elements.



Figure 10.2

Personal analogy – a glass of wine

- Characteristics
 - clear
 - fruity
- Emotions
 - happy at dinner
 - friendly at parties
- Feeling when using
 - sophisticated
 - tired
- Object feelings
 - wanted
 - important

Direct analogy

The *direct analogy* compares the problem with homogeneous facts, information or technology. A heating system might be compared with a volcano, and from this new ideas may arise. A direct analogy is a mechanism by which we try to make comparisons with analogous facts, information or technology. In making use of this device we have to search our experiences and knowledge to collect phenomena that seem to exhibit similar relationships to those in the problem in hand. It is often fruitful to compare animate systems with inanimate systems, or to make comparisons between biological, ecological and other natural science systems and social systems.

Example

Decision making can be likened to finding one's way across paths over a marsh. There are many pitfalls and wrong turnings along the way. The various paths have different pay-offs, so we need to estimate the value of the various pay-offs. Will they enable us to reach our destination or objective?

The idea is to describe a clear, straightforward relationship between the problem and some object, thing or idea with the expectation of being able to transfer insights back to the problem in hand.



Figure 10.3

Direct analogy – paths across the marshes

- What are seemingly paths across the marshes often lead you the wrong way.
- Unfamiliar and potentially hazardous options need careful prior analysis when making decisions in order to ensure that good choices are made

Symbolic analogy

Symbolic analogy is the use of objective and personal images.

If the problem is to fit fifty people into a small conference room, it may be likened to cramming sardines into a can or the London Underground.

Symbolic analogy involves making use of objective and personal images to describe a problem (e.g. like an Indian rope trick, like a thief in the night, like a pirate).

Example

It may be difficult to get hold of the boss because the boss is nearly always out of the office. Finding the boss may be likened to finding the elusive Scarlet Pimpernel. It might well be

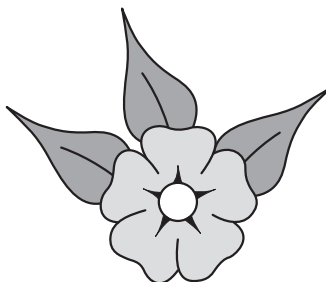


Figure 10.4

Symbolic analogy– the Scarlet Pimpernel

that in trying to suggest ways of finding the elusive flower (or fictional character of Baroness Orczy, who shares the same name) we may get some further insights into how to keep tabs on the whereabouts of the boss.

- Getting hold of the boss is like finding the Scarlet Pimpernel. 'We seek her here, we seek her there, we seek her everywhere!'

Fantasy analogy

This is based on Freud's notion that creative thinking and wish fulfilment are strongly related. It is usually prefaced by the words 'How do we in our wildest fantasy. . .?' For example, when considering a problem dealing with managing difficult staff at work we might pose the question:

How do we in our wildest fantasy (IOWF) manage difficult staff without undue acrimony in the workplace?

This may well take us into the realm of considering conflict-avoidance or conflict-mollification management strategies.

Fantasy analogies take the most desirable solutions, which may be impossible to implement but which may lead to some further practical ideas. This is similar to the *intermediate impossible* technique advocated in lateral thinking.



Figure 10.5

Fantasy analogy – peace

- How do we IOWF want to manage the office?
- So that peace reigns all the time
- Solution: adopt style of management based on conflict

CONDUCTING SYNECTICS SESSIONS

The management of synectics sessions is crucial to their success. If the session is not well carried out, the psychological states that are required by users of the technique will not be achieved.

Gordon laid down quite specific criteria for group membership and composition. He suggested that group members should be frequent users of analogies and metaphors, have an attitude of assistance, well coordinated bodily movements and the capacity to generalize. They should possess personality traits such as emotional maturity, 'constructive childishness' and 'risk taking', and be non-status-orientated. They needed to show a commitment to the group and its purpose and be 25 to 40 years of age. Gordon's suggestion, however, should not be seen as an absolute guideline, as far as age is concerned.

The group should not have too many experts. The problem owner will invariably be the problem content expert. It is easier on the leader if all are of equal status. It is also useful to have a couple of people who are good at coming up with wild ideas. These people may set the cultural norm of the group, which otherwise might be unwilling to try wild ideas. It is also advantageous to have some members who have been trained in the use of synectics.

The problem owner

He or she should be warned of what to expect, so that he or she is not alarmed when the proceedings appear to be running off in a seemingly irrelevant direction. It is also useful for the problem owner to understand the synectics process.

The group leader

The role is that of a process leader who guides only the problem solving process. The leader should not get involved with the problem content in any way. Leaders should direct the process, not contribute ideas, suggestions or possible solutions, let alone the best way of resolving the problem. The group leader should determine the success of the process by observing, and asking for, the client's reactions to what is going on.

The synectics session leader needs to be seen as serving the needs of the group in order to gain commitment, enthusiasm and the best ideas. The group leader is also responsible for ensuring that the group members obey the rules; for encouraging speculation; for recording all the ideas; for checking with the problem owner that the group is on the right track; and for managing the time.

The group

Since the group may generate ideas faster than the leader can write them down on the flip charts, group members should be encouraged to jot ideas down on notepads until required. Half-formed and wild ideas should be recorded, and group members should support each other's efforts by complimenting them where appropriate.

Process

The problem owner first describes the problem. The next stage in the process is 'goal orientation'. Here one tries to view the problem situation in a variety of ways, so that one looks for a solution in the most appropriate direction. 'Goal wishing' stresses that

speculation/wishing is permitted and desired. We are seeking different angles or restatements of the problem. This is a time when the group members must not evaluate their own ideas. Way-out ideas often trigger other ideas in group members. The problem owner should offer directions as to which of the ideas appear to offer the best way forward and so direct the group members. 'How to' or 'I wish' statements are quite useful. The latter encourage speculation, while the former convey positive direction.

Selection

The problem owner needs a chance to reflect on the restatements made in order to select two or three that best describe the problem situation. He or she should be warned against selecting only those that appear obviously practical, and be advised to choose those that are intriguing, novel and interesting. The problem owner is asked to say what led him or her to choose the selected 'springboards'.

If no specific action is indicated by a 'springboard', the next step is to generate ideas as to how the circumstances it describes might be brought about – possibly by using an excursion.

Excursion

Various types of excursion are used in the synectics process. The choice of excursion depends on the degree of novelty required in a solution, the element of risk the leader is prepared to take and the type of material which is being worked on. Hicks (1991) distinguishes between 'imaging or fantasy excursion' and 'example excursion'. The imaging excursion is possibly the most unorthodox form of excursion and can be a potential disaster with a conservative-minded group – although it often works dramatically well when it is least expected and produces the most innovative ideas.

Fantasy excursion

For a fantasy or image excursion the group is asked to describe a mental picture/story inspired by the last item in a word-association preliminary exercise, starting with a word taken from the 'springboard'. One person will lead off, and then every other person in the group has to add to the story. They should be invited to jump in whenever they like and told that the more colourful, outlandish, weird or exotic the story the better. It is usually better to keep the story in the same location, if possible, as this makes for better imagery. Everyone should try to add about a minute to the story, and then someone else takes over. The changeover may be left to the discretion of the leader.

If the story tends to stagnate on some minute detail of one particular image, the leader can ask someone to make something surprising happen. Conversely, if images are insufficiently developed because storytellers move too quickly to other images, the leader can pin people to one scenario by asking for more detail. People may be anxious about producing mental images in public and about their ability to contribute to the story. It is, however, the violent changing of direction and having to build another mental image after the destruction of the first that makes the story rich in speculation and evocative images.

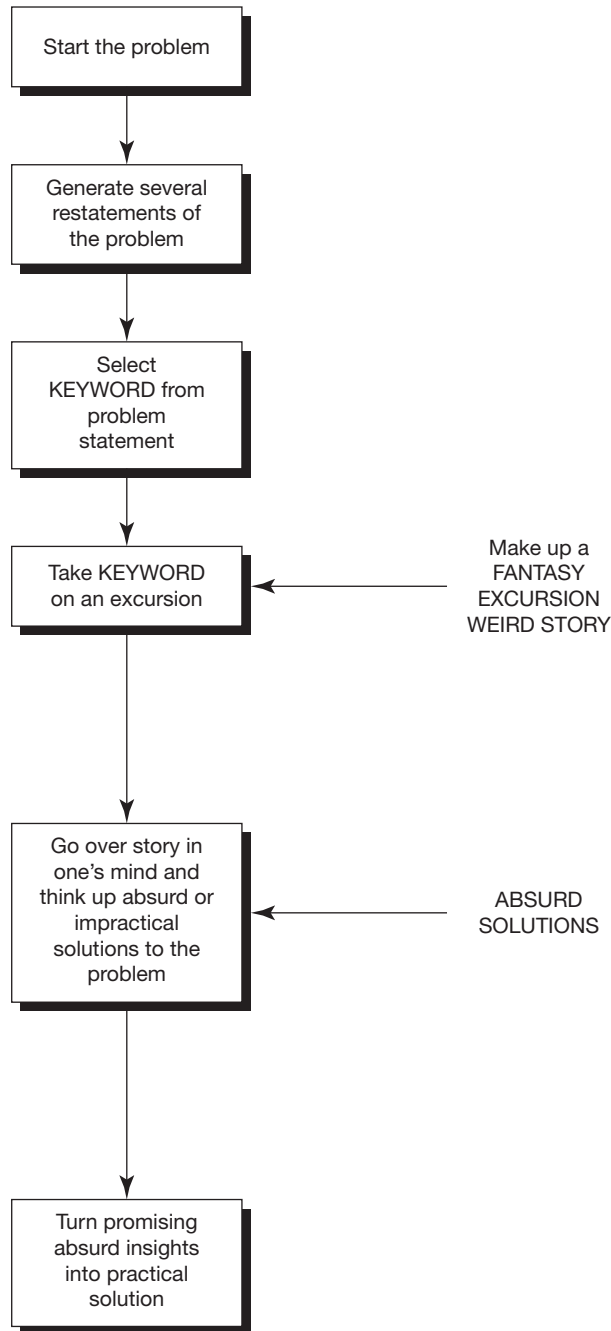


Figure 10.6
The synectics process: fantasy excursion method

Absurd solutions

When every group member has had at least one chance to contribute to the story the leader stops the imaging and asks the group to replay the story in their mind and try to think up some really absurd or impractical solutions to the problem. The absurd solutions are written up on the flip chart.

Having moved so far from the problem with the fantasy excursion, it usually becomes desirable to return to the real world and the problem in several stages, the first of which is this drawing up of *absurd* solutions. If a group member immediately comes up with a sensible and novel solution, one should obviously not reject it.

The leader needs to check with the problem owner to see if any of the absurd solutions intrigue, fascinate or appeal to them. There should be no problem with picking too practical a solution as there should not be any. After the problem owner makes his selection the leader asks the group to examine the chosen absurd solutions and to try to find ways of changing them into something more practical and closer to reality, while retaining as much of the original idea as possible. It is better not to attempt to do this in one step but to spend some time modifying them, because there is a tendency to lose the novel feature contained in the absurd solution by jumping back to reality too quickly.

Example excursion (includes the use of analogies)

The *example* excursion is perhaps most commonly applied and easiest to interpret, though it is thought to be less generally applicable. It is introduced in the same general way as the fantasy excursion. When moving into the excursion we ask the group for examples of a keyword chosen from the problem restatements in a different 'world'. The choice of appropriate world is a matter of past experience and knowledge of those that seem to have worked well in the past. Almost any 'world' can be used – e.g. sport, fashion, warfare, nature, physics, astrophysics, engineering, and so on. Examples, of course, are only one form of analogy, and one can also ask for other forms of direct, personal, fantasy or symbolic analogy – see the examples of synectics in action in the next section. One often combines examples with some other form of analogy. All ideas are, of course, written up and eventually explored to see how they can provide insights into the problem under consideration.

A typical session might involve:

- 1 State and restate the problem.
- 2 Choose a keyword.
- 3 Take the keyword on an excursion into a different world – e.g. nature – asking for examples of the keyword in that world.
- 4 Ask what it feels like to be that example in the different world – *personal analogy*.
- 5 See if any of the material listed so far gives insights into the problem.
- 6 If required, continue with more excursions.

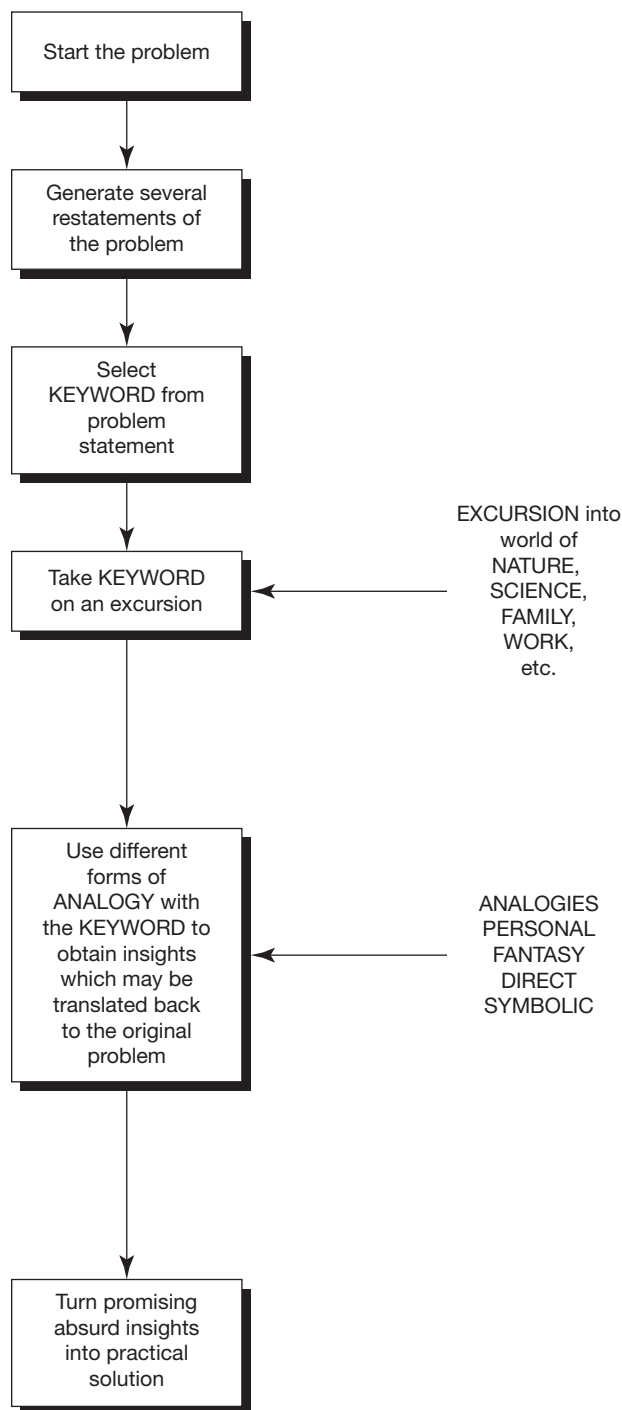


Figure 10.7
The synectics process: example excursion method

SYNECTICS IN ACTION

Fantasy excursion

A firm was looking for capital to invest in some risky ventures.

Problem statement: how to finance risky ventures.

Word selected: ventures.

Word association preliminary: ventures, adventure, excitement, journey, aspiration, jungle, desert, joy.

Weird story: 'Joy sat entrenched in the bob-sleigh. The ice seemed to seep up through the runners as it began to move. The speed gathered. The sun glinted on the mountains overlooking the course. The first corner came. All was safe. The angle steepened, and the speed increased. Joy's helmet touched the ice wall. A reverberation rang through her ears. Everything went out of focus except the track. It was white, fast and steep. A big corner. Almost turned over. The finish in sight. Would she stop? Yes. Hugs and kisses. All over.'

Absurd solutions

- 1 Win the money on the races.
- 2 Give potential backers a ride on a bob-sleigh and charge them exorbitant fares for the ride.
- 3 Put on very risky bob-sleigh tournaments and charge spectators for the privilege of watching.
- 4 Produce all kinds of spectacular events that will have great entertainment value and will attract sponsorship and TV rights.

Practical solution

Make the ventures look very attractive propositions, stressing that what appears to be a risky venture will, in fact, be quite safe and have substantial pay-offs.

Example excursions

Two groups, on separate days, but under the direction of the same synectics leader, were assigned the task of finding insights into the problem of how to reduce stress at work. The following episodes occurred:

Group 1: Problem definition/redefinition:

- How to reduce stress at work
- How to work in a positive way
- How to improve morale and reduce absenteeism
- How to improve relations between staff
- The word *reduce* was chosen by the leader, and the group suggested the world of *forestry* for an excursion.

The group was then asked to think of examples of using *reduce* in the world of *forestry*.

- putting fires out
- reducing tree disease
- cutting the undergrowth
- removal of weeds
- cutting paths through the forest
- deforestation
- stop illegal hunting of animals in the forest

The leader then focused on *animals being hunted in the forest* and asked the group to imagine what it would be like to be *an animal being hunted in the forest*:

- browned off
- scared
- premature death
- looking for relatives that have been killed
- running all the time
- feeling it never stops (relentless pursuit)
- thinks it is a game
- unfairness
- pain, misery, suffering
- survival of the fittest
- revenge
- victimized
- trying to find somewhere to hide

Group 2: Problem definition/redefinition:

- How to reduce stress in the workplace
- How to make work pleasurable
- How to work in a more peaceful company
- How to reward good performance

The word *pleasurable* was taken, and the suggested excursion was the *family*. Examples of *pleasurable* things in the context of the *family* generated by the group were:

- home cooking
- support
- cosiness
- birthdays
- family outings
- holidays having meals together
- gatherings
- family intimacy
- quarrelling
- storytelling at bedtime
- sport (doing it together)

The word *gatherings* was then chosen for a further excursion, and the group was asked to give examples of the kind of *emotions* that might be encountered at a family gathering:

- happiness
- sadness
- satisfaction
- pride
- frustration
- protection
- love
- anger
- togetherness
- belonging
- boredom
- tension

Now you consider how the data might be used to give insights into the original problem.

PROBLEM: 'HOW TO MAKE OUR ADVERTISING MORE EFFECTIVE'

Restated as 'How to give our advertising more punch'.

Keyword taken 'punch'.

Ideas about 'punch' from the world of boxing: jab, hook, knock-out, body, head, ribs, rabbit, clinch. . . .

What does it feel like to be a 'knock-out'?

- | | |
|-------------------|-------------|
| 1 Significant | 4 Strong |
| 2 Penetrating | 5 Rampant |
| 3 Finishing touch | 6 Explosive |

All of the above seem applicable to the advertising problem. For example, it suggests content – the advertising must contain highly significant messages and images that will awaken interest in the target audience. Moreover, in the presence of all the 'noise' created by competitive advertising, the advertisement must be able to penetrate through to the reader. There must be something very attention-getting about it. Perhaps it should contain strong, rampant and explosive messages and images. The finishing touches to the advertisement are also important – its timing, media slot, etc.

Itemized response

We should not reject ideas that are not perfectly formed. Indeed, the suggestion is to work on and develop the ideas into more practical solutions. Synectics has developed this simple technique of itemised response, which allows a possible solution to be developed from any idea, using gentle evaluation that encourages the ironing out of minor concerns rather than dismissal of the idea. It starts from the assumption that all ideas have value; and thus, before any flaws or imperfections in the idea are pointed out, some of the good points (say 3–5) are listed. This reinforces the value of the idea, and justifies the additional time that will be spent overcoming concerns about it.

The problem owner is asked to identify practical, helpful or attractive aspects of an idea, giving reasons wherever possible. It may be helpful to let the group contribute to this also, since they may see benefits not immediately apparent to the problem owner. The leader asks for the problem owner's major concern with the idea, expressing this as a 'How to/I wish' in order to give the group a direction for further development of the idea in order to overcome this concern. The leader then gathers ideas from the group and writes them on the flip charts while asking the problem owner to paraphrase the suggestions to ensure understanding. If the group comes up with a suggestion that only partially overcomes the concern, the IR process is repeated with this latest suggestion. As the idea develops in this way it becomes more difficult to get three 'new' good points each time, but the time spent trying is usually worthwhile.

Having resolved the major concern, the group tackles other concerns the problem owner may have with respect to the original idea, always taking them one at a time. The process continues, gradually homing in on a possible solution, a course of action which the problem owner can implement without further help from the group. The leader then writes up the possible solution.

THE SYNECTIC TRIGGER MECHANISMS

- Synectic trigger mechanisms catalyse new thoughts, ideas and inventions.
- Synectic theory is based on disruptive thinking – similar to the po operation of Edward de Bono.

THE SYNECTIC WAYS OF WORKING

- Synectics is based on the fusion of opposites.
- Synectics is based on analogical thinking.
- Synectics is synergistic. Its action produces a result that is greater than the sum of its parts.

QUESTIONS

- 1 A firm is having problems in recruiting new managers to join its ranks. Discuss how the use of synectics might lead to ideas on how to get to grips with this problem.
- 2 What is synectics? Illustrate its application to a problem of your choice.
- 3 When might synectics be most appropriately used in creative problem solving?
- 4 Illustrate the different forms of analogy that might be used in a synectics session (i.e. personal, direct, symbolic and fantasy analogy).
- 5 What is the purpose of an excursion? Suggest 'excursions' and an example of the following italicised keywords, in the excursions in each of the cases below:
 - (a) How to *ignite* enthusiasm for a project.
 - (b) How to *liquidate* assets to solve a financial problem.
 - (c) How to *purify* the air in departmental meetings.
- 6 Work through a synectics session to gain insights into each of the following problems:
 - (a) How to improve communications between management and workers.
 - (b) How to prevent industrial espionage.
 - (c) How to minimize the number of industrial accidents.
 - (d) How to do more management work with fewer resources.

CASES

Crossing the river

The bridge over the river is very busy at peak traffic times in the morning for three hours and similarly in the evenings. Long queues build up on either side from the dual carriageways. The bridge was built in the 1950s and has only one lane in each direction. On either side of the river there are also two roads that feed into the approach to the bridge in addition to dual carriageways. The bridge is a steel arched truss bridge and the steel girders need to be painted regularly and after sixty years' use need regular maintenance and repairs as well. This means that lane closures on the bridge are inevitable from time to time and even on occasion the bridge is totally put out of action. The river runs east to west and there are no crossings of the river to the west and the nearest one to the east is some fifteen miles away. There are large concentrations of industry on either side of the river and two towns face each other across the narrows spanned by the bridge. The river is around 300 metres wide at this point.

There has been talk of replacing the bridge with another for years and recently central government pledged support for such a project. In the current climate of austerity, however, it seems unlikely that any movement on building a new bridge is likely in the foreseeable future.

Question

Can you think of alternative ways of solving this problem?

Jo Soap

Helena is deputy head of department and is in charge of the office when the boss is away. Her usual duties involve preparing departmental budgets and reports for the company's directors and handling complaints and other difficult problems both by letter and over the telephone. She is tactful, efficient and cooperative.

Jo Soap is in charge of the secretaries and manages a group of five female employees. She has to ensure that clerical work is progressed when it is passed on by the department head, Helena or any of the administrative assistants in the department. Unfortunately, Jo tends to have an authoritarian attitude which is resented both by the women who work under her direction and other people in the department. She has demonstrated her rigidity to Helena on many occasions in the past, insinuating that Helena has not been reasonable in expecting work to be done by a particular time because reasonable advanced notice has not been given. There is little truth in these allegations, though on occasion expectations might have been regarded as ambitious by some people.

A short while ago an official complaint was lodged with the head of department by the secretaries about Jo Soap's approach to managing their work. The women even cited Jo's inappropriate behaviour towards Helena as evidence to support their complaint. The head of department had approached Helena concerning the matter, but the latter thought she was well equipped to handle her personal difficulties herself – a response which seemed to please the boss, who did not really want to get involved in hassles of this type.

In the last few weeks, Jo's attitude towards Helena has become more hostile. Finally, just before Easter, when the head of department was away for a few days, Jo told the secretaries that they need not come in the two days before the start of the holidays. She also said that she would not be in, either. This was something that had not been the custom and practice in the past, and secretarial support was always available up until the start of the holiday period. Helena did not know about the planned additional holidays until the day before the women were about to take the time off. Furthermore, Jo had been taken ill and was not available for consultation. The result was that there were pressing jobs that required doing and no one to do them. However, following a persuasive talk with Helena, a couple of the women agreed to make themselves available to cover any necessary work that was required to be done.

After the break, Jo complained bitterly to Helena about interfering in her work. She was extremely rude to Helena, despite Helena's explanation that at the time Jo had been ill and she had therefore to intervene herself as there were urgent jobs to be done.

Helena recognizes that Jo is very efficient in her job but is rightly concerned that matters could get out of hand, and she dreads having to interact with Jo at all. Something will have to be done about the problem, but she is unsure what action to take.

Question

How would you advise Helena? Use synectics to gain some insights into the problem.

Consultants who don't like meetings

Creative Marketing Consultants offers a wide range of expert marketing consultancy services to its clients. The firm employs ten consultants and is based in the West End of London in exclusive offices not far from Hyde Park Corner. Unfortunately, although the team the chief executive has got together are very good individual thinkers, they hate having to attend internal meetings and prefer to work outside the office with clients. Internal meetings are poorly attended, and a variety of plausible excuses are usually offered for being absent. The chief executive feels that in order to foster a creative spirit in the staff it is essential to encourage an atmosphere in which people are free to come and go as they please and to have as much flexibility as possible in their working arrangements.

The chief executive called in a creativity consultant to help deal with the problem. A one-day seminar was presented to the staff in which, ostensibly, a range of creative thinking and problem-solving techniques were presented and discussed. In one of the afternoon sessions a synectics session was held during which the problem of getting staff to attend meetings was discussed. Six of the consultants attended the synectics session, which proceeded along the following lines:

First the problem was stated: how to encourage staff to attend meetings.

The word *meetings* was selected as the keyword for an excursion, and the world in which the word was taken on an excursion was the *family*.

Examples of meetings suggested included:

- weddings
- funerals
- birthdays
- parties
- Christmas dinners
- golden weddings
- christenings

‘Weddings’ was selected for further exploration, and the group was asked to suggest what it felt like to be a bride or bridegroom. Answers included:

- late
- hassled
- nervous
- anxious
- over-dressed
- putting on a show
- happy
- well organized
- showered with confetti
- watched
- religious experience
- expensive on someone’s pocket

The leader felt that the above ideas represented food for thought with respect to the original problem that was posed, but that the line of reasoning was not as productive as he would like. He decided, therefore, to select another word from the list of meetings for the family. ‘Funerals’ was taken, and the group was asked what it feels like to be at a funeral. Answers included:

- depressed
- intoxicated
- boxed in
- missing a friend

The leader then selected the word ‘depressed’ and asked what it would take to make someone who was depressed at a funeral not ‘depressed’. Answers included:

- someone friendly to talk to
- free drinks
- entertainment
- party atmosphere
- being a beneficiary under a will

Question

Suggest how the session might have continued and concluded.

Busy lines

‘What are we going to do about these phone bills?’ Sam asked, exasperated by the rising costs.’ Not only are expenses from this source rising out of all proportion, but also it is becoming increasingly difficult to cope with the number of incoming calls because of the time customers are spending on the phone to us.’

‘But is this the real problem?’ Sally asked. ‘Perhaps we ought to think more about it.’

The two of them decided that they ought first to try to define the problem and then to try to think up some ideas. This produced some interesting results. Redefinitions such as:

‘How to ensure people have the right knowledge.’

‘How to reduce customer calls, or stop them altogether.’

However, when conventional brainstorming was used to try to dream up ideas to solve the problem – both as given and as redefined – no really good answers seemed to be forthcoming.

‘What we really need to do is try one of the more adventurous techniques, such as synectics,’ Sally suggested. Sam agreed, and the two of them decided to get together a team of people in the offices to generate some ideas. ‘Which definition should we take?’ Sam asked. ‘How about:

“How to reduce customer calls, or stop them altogether?”’ Sally suggested. ‘OK,’ said Sam.’ Let’s take “reduce” or “reduction” as our keyword and take it for an excursion.’

Questions

- 1 How might the synectics session continue from the point arrived at in the case?
 - 2 How else might it have developed if a different problem definition had been taken? Illustrate your answer.
 - 3 Compare the kind of solutions you obtain with the two approaches.
-

Finding a new advertising platform

There is so much clutter surrounding advertising. If you want to get your message across to the target market, you would do better to stand on the roof-top of your office in central London and shout it out to all who pass by. Such is the frustration that many firms now feel about advertising. People just ignore it, look the other way, switch it off (if it is on TV) or hum songs in the car if it is on the radio, yet firms still spend millions of pounds, dollars, euros and rupees to get messages about their products and services into the media.

Advertising, on the face of it, is wasteful, and arguably much of the money spent on it could be put to better use. That, however, is a rather negative way of looking at matters. Advertising messages have to be marketed in the same way that products and services are marketed. Successful products have unique selling features, and this is exactly what advertising messages should strive to have as well.

An advertising agency was keen to put the above ideas into practice and was working on a particular campaign for a particular client. The agency decided to use synectics to come up with some insightful ideas. The problem was stated as:

How can the product be advertised in a unique and different way?

The keyword chosen was the word *unique*, and an analogy was sought in the world of nature. The group sought first to think of things that were unique in the world of nature. Ideas included:

- patterns on butterflies
- snowflakes
- patterns on the bark of trees
- rain streaming down the window pane

Using the idea of patterns on butterflies the group next sought to use a personal metaphor. They were asked what it would be like to be patterns on butterflies. The following ideas were generated:

- stationary
- vivid
- multicoloured
- floating on air
- bright and distinctive

Question

Illustrate how the session might continue and conclude.

Coping with stress

‘Every time I have to make a presentation I get stressed out,’ Joanna complained, shaking her ringlets as if to signify that she was throwing off the effects of stress. ‘What shall I do?’

‘Well, let’s have a *synectics* session to see if that will produce any ideas,’ Jan smiled. Jan always smiled. No problem was too difficult for him to consider and solve.

‘How do we do that?’ Joanna asked.

‘Well, first we have to state the problem and then take a word from the problem statement on an excursion.’

‘The problem is me and stress,’ Joanna sighed.

‘What about “how to deal with stress when delivering presentations”?’

‘I think “how to stop feeling sick every time I am under pressure” is better.’

‘OK! Let’s take the word “pressure” on an excursion. Let’s go into the world of cooking. Give me some examples of pressure in the world of cooking.’

‘Pressure cooker, getting meals ready for you, crushing garlic, grinding nuts or coffee, making a purée, making bread, squeezing the icing on to a cake, rolling pastry, getting the juice out of apples and oranges, mashing potatoes and parsnips. . . .’

‘Stop, stop. That’s great. Now we are getting somewhere. Just let me finish writing all this down,’ Jan interrupted.

Question

Suggest how the session might continue. Try to gain some useful insights that might help Joanna with her problem.

Fantasies about competition

‘Competition is the root of all evil,’ sighed Wendy.

‘Competition is good for business,’ John retorted. ‘That just shows how much you know about business.’

‘Well, somehow we have just got to meet the new menace.’ Wendy smiled. ‘If we don’t, then it will soon put us out of business.’

‘Exactly. So we are going to have to respond to their price-cutting strategy somehow,’ John said seriously.

‘Synectics, that is the answer,’ Wendy grinned. ‘Let’s have a synectics session. I suggest that we get the team together and have a go at a fantasy excursion.’

‘Well, it might work,’ John said quietly. ‘I know, let’s take the word “competition”. . . .’

‘And find a word associated with it,’ Wendy interrupted.

‘Football, cricket, cup, cigarettes, lighter, fuel,’ Ben cried out, rising from obscurity in the recesses of the open-plan office.

‘Right,’ said John. ‘Let’s have a weird story about fuel.’

Question

Illustrate how the session might continue. See if you can find any general strategies as a result which might help counter the competition’s moves.

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Paradigm-breaking techniques

INTRODUCTION

Achieving paradigm breakthroughs and being able to take advantage of them through successful commercialization of the ideas and innovation they produce can lead to rich rewards for those who bring them about. We introduce this chapter by looking at how a breakthrough scientific idea was achieved many years ago – unfortunately without bringing great riches to the person involved. This is followed by examining a number of techniques that have been tried out in recent times to achieve breakthrough ideas. Visualization, Symbolic representation and Rich pictures are all mechanisms that can support this kind of thinking. Two other mechanisms are also discussed: Wishful thinking and Role playing. Finally, we point to the benefits that disruptive technologies can bring for those who discover and commercialize them. Such breakthroughs reflect paradigm shifts or breakthroughs. The techniques can require a degree of divergent thinking though experience and knowledge of the subject matter is vitally important. As group creative problem-solving techniques, both of these qualities need to be present. In addition, a suitable skilful facilitator is a decided asset.

WEIGHTS FOR THOUGHT

Before we move on to look at a number of techniques which are thought to aid the process of breakthrough ideas, it is useful to consider the historical account of a breakthrough in thought that occurred nearly a century and a half ago.

We have noted early on in the book how many of the well-known scientific ideas appear to have been hit on in a way for which there does not seem to be any particular rationale – the Benzene ring idea of Kekule is an example. Yet it may be hard not to believe that there was some kind of systematic thinking and problem solving at work. We do, in fact, have an account of how one important discovery was made. Mendeleev, like Kekule, was thought to have made his discovery in a dream.

Kedrov (1966), however, was able to throw further light on the matter. He describes in some detail Mendeleev's formulation of the Periodic Table of the Elements. Mendeleev was looking for a pattern that could be applied to all of the known elements at that time. His starting point was the atomic weights of these elements but he found that this was not enough. He then switched to comparing and contrasting groups of elements based on their atomic

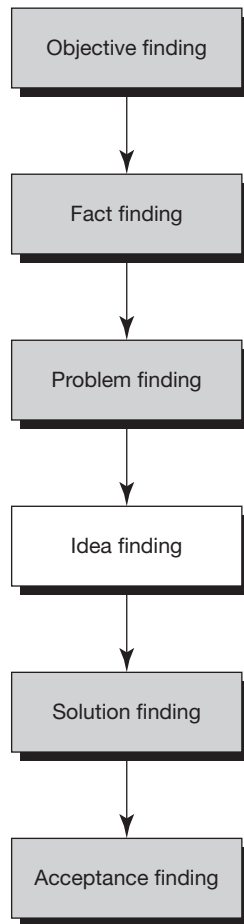


Figure 11.1

Position of this chapter within the CPS process

properties and ordered each group according to their atomic weights. This reduced the space of comparisons considerably and he noticed patterns starting to emerge.

Encouraged by this, he decided to use cards to represent elements ordered in a two-dimensional matrix space, with one dimension representing the ordering of atomic weights (horizontal rows) and the other general chemical properties of the elements (vertical columns).

Kedrov speculated that this analogy presented itself to Mendeleev because he was an avid player of the game of patience. Mendeleev laid out the cards containing the identities of chemical elements in the same orthogonal manner as he might do with the playing cards – that is, according to suit and value. This enabled Mendeleev to simplify his representation of the problem. Although there were still elements to be discovered, the new representation made clearer the organizational principle of the table that the properties of elements stand in periodic relationship to atomic weight.

			Ti=50	Zr=90	?=180
			V=51	Nb=94	Ta=182
			Cr=52	Mo=96	W=186
			Mn=55	Rh=104.4	Pt=197.4
			Fe=56	Ru=104.4	Ir=198
			Ni=Co=59	Pd=106.6	Os=199
H=1			Cu=63.4	Ag=108	Hg=200
	Be= 9.4	Mg=24	Zn=65.2	Cd=112	
	B=11	Al=27.4	?=68	Ur=116	Au=197?
	C=12	Si=28	?=70	Sn=118	
	N=14	P=31	As=75	Sb=122	Bi=210?
	O=16	S=32	Sc=79.4	Te=128?	
	F=19	Cl=35.5	Br=80	J=127	Tl=204
Li=7	Na=23	K=39	Rb=85.4	Cs=133	Pb=207
		Ca=40	Sr=87.6	Ba=137	
		?=45	Ce=92		
		?Er=56	La=94		
		?Yt=60	Di=95		
		?In=75.6	Th=118?		

Figure 11.2

Mendeleev's table as published in 1869, with many gaps and uncertainties

From this he noted among several other things that:

- 1 Chemically analogous elements have either similar atomic weights (Pt, Ir, Os), or weights that increase by equal increments (K, Rb, Cs).
- 2 The elements distributed most widely in nature have small atomic weights.
- 3 One can predict the discovery of many new elements.

The Periodic Table has proved to be extremely useful in facilitating the further study of less well-understood elements and discovery of the ones that were unknown at the time, based on the underlying logic of the table.

Based on Mendeleev's approach, we might conjecture that the creative process for gaining paradigm shifts or breakthroughs exhibits certain patterns:

- 1 Discerning the essential and solvable issues in the problem space while ignoring 'noise' that could easily distract a less skilled person.
- 2 Attacking the manageable alternatives first, setting aside the more challenging ones for later.

Mendeleev's command of knowledge in his field was essential. Some of the breakthroughs that materialized were due to the circumstances surrounding his search activity such as the game of patience. The strategy of deriving general principles from specific relationships helped combine the search in the domain of problem spaces with the search for solutions within a given problem space.

In Mendeleev's case, ground-breaking discovery required a shift in the problem space that resulted from the discovery of a new principle (periodicity of elements), a new representation (playing cards of the game of patience) or a new frame of reference (comparing the atomic weights of the elements).

Put in simple terms, Mendeleev's procedure was:

- 1 List attributes of the phenomenon of interest – the atomic weights of the elements.
- 2 Ask whether this shows any discernible patterns – if not, then there may be some other attribute(s) that are important. In this case, it was the chemical properties of the elements.

Can the elements, in conjunction with the two identified attributes, be organized or visualized within a frame of reference that facilitates patterns of relationships to be observed? Possibly using an analogy? In this case, yes. Mendeleev used something with which he was familiar – laying out cards as in a game of patience so that they formed a two-dimensional matrix as shown in figure.

This simple procedure of identifying one or more sets of attributes relating to the problem of interest and visualizing them or organizing them within a new or analogous frame of reference led to the identification of a solution to the problem in hand.

Let us now turn to some of the customary suggestions regarding techniques that can stimulate paradigm creating or breaking.

PARADIGM-BREAKING TECHNIQUES

Paradigm-breaking techniques can help participants to develop fantasies that may help them to generate novel ideas. While the use of synectics was discussed in the last section, it is possible that the 'fantasy analogy' mechanism employed in synectics could lead to paradigm shifts.

Anyone who has regularly filled in crossword puzzles will know that it is easier to find the required words when some of the letters are already in place. When solving problems, performance is often improved when one is given a clue than when no clue is given (Bowden, 1985). It is argued, too, that when clues take the form of pictorial representations they are more likely to elicit associated information than if they had been presented as words (Berry *et al.*, 1997). Indeed, research indicates that pictures permit more easy access to semantic memory (Seifert, 1997). Perhaps, not surprisingly, some people maintain that pictures help creative thinking. For instance, Do and Gross (1995) argue that a more direct visual, graphical reminding scheme based on sketches can help designers recall interesting references from various domains. Such observations promote the notion of using pictures as clues for solving problems requiring insights (Schwert, 2007).

Next we shall consider some approaches that make use of these suggestions. First we look at vision building and symbolic representation. Next we move on to look at the use of rich pictures.

Visualizing

It is well known that Albert Einstein had considerable powers of imagination and that he used these skills to get to grips with problems in theoretical physics using mental images. Words or language did not come into his process of thinking but only signs or blurred images capable of being reproduced or combined. (Limont, n.d.) It was only after the combinations were sufficiently developed and reproduced that he tried to put the thoughts into words (Shepard, 1978). For example, when coming up with the formula concerning the equivalence of mass and energy, Einstein claims that this result was not achieved by means of verbal deduction based on the formal mathematical apparatus but by means of intuition which involved visual images (Shepard, 1978).

Several other scientists used visualization extensively in their research and discoveries. Michael Faraday transformed visual images he conceived in the course of his research. His representation of invisible lines of electromagnetic power as thin tubes in space twisting around a magnetic and electric current is an example of this (Limont, n.d.). Another extensive user of visualization was James Clerk Maxwell. In creating his theory of electromagnetic field he used a visualization version of Faraday's lines as electrostatic tubes through which electric current flowed in the form of a liquid similar to water. From this he worked out a mechanical model, taking into consideration magnetic attraction and electromagnetic induction. Finally, he put everything in the form of an equation (Limont, n.d.). Examining the process adopted by Maxwell we note three stages:

- 1 Visualize the concept as a physical entity – use a (visual) analogy if necessary.
- 2 Work out a mechanical model or just work out how the model actually works.
- 3 Formulate the observed process in terms that can be generalized by users in practice to applications.

Visions play an important part in how we conduct our life. A vision is a wish of what we want to happen. In some cultures it is believed that by making a wish that wish will come true, and day-dreaming is an excellent form of visualizing.

Symbolic representation

One constructs a diagram or picture of a problem or situation with the use of symbols (Van Gundy, [1981] 1988; Hicks, 1991). It may be useful to generate a set of symbols that can be used on a regular basis by those involved in the creative problem-solving sessions. Users of this method will then quickly learn the meaning of the symbols, be able to develop the list of easily understood and recognized symbols, and quickly build up complex pictures of the problem situation.

The steps are as follows:

- 1 Write down a statement of the problem.
- 2 Redefine the problem or restate it in terms of the basic underlying principle which is involved.

- 3 Insert into the picture-carrying device – flip chart, computer graphics program, etc. – an abstract symbol that generally represents the underlying principle underpinning the problem.
- 4 The symbol inserted at stage 3 represents the starting-point, and through free association another symbol, prompted by the first one, is inserted (or drawn).
- 5 A third symbol suggested by the first or second symbol is inserted or drawn, and matters proceed in this fashion using free association until several symbols have been used. Each symbol is used as a stimulus, and any ideas suggested are recorded.

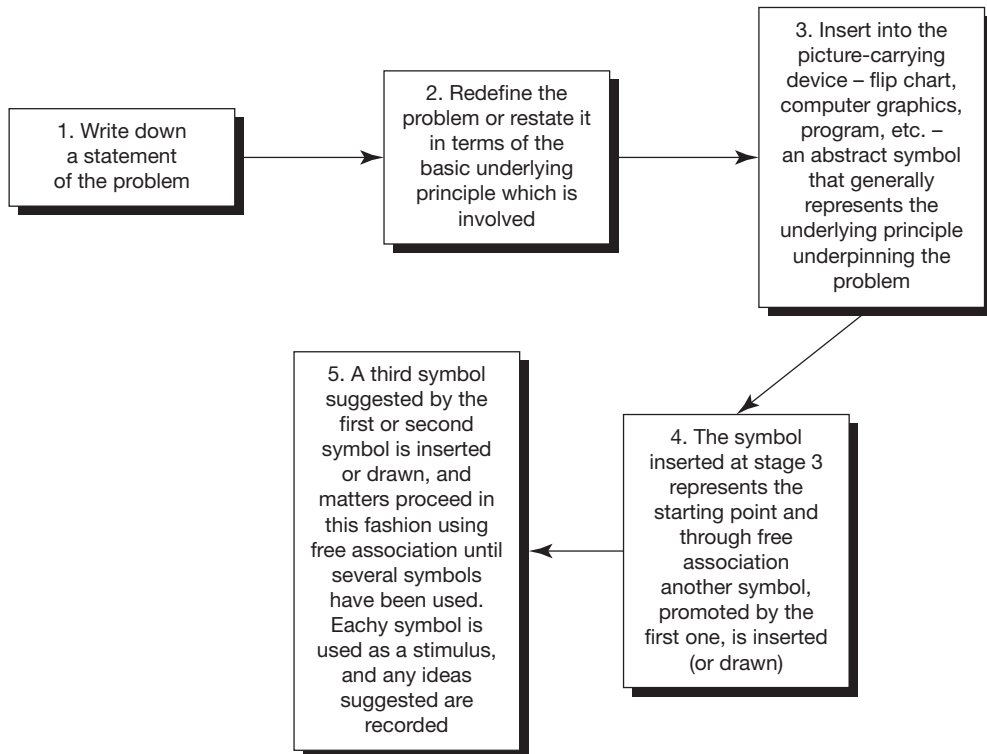


Figure 11.3

Symbolic representation

In the problem depicted in the symbols shown in Figure 11.4, the alarm bells are sounding at the factory because there is a problem. The key seems to be to cut out as much of the paperwork at the factory as possible so that people can get on with the job of things.

Rich pictures

This is an approach that can help participants look at problems from a totally different perspective, and it can change the patterns of thinking within the group. Rich pictures can be used as follows:

**Figure 11.4***Symbols can be used in pictures*

- 1 Develop a problem statement and write it on a flip chart.
- 2 Ask each individual to draw two pictures. The pictures may be metaphors for the situation – for example, vehicles or animals. The first drawing should be a picture of how the participant sees the present situation.
- 3 Ask each participant to describe the picture of the present. He or she should describe not only the picture but also the properties of the objects drawn and why they were drawn that way. Next, the individual should describe the picture of the future, again including the properties and the relationships of the objects.
- 4 Ask the participants to generate new ideas based on the descriptions.

Rich pictures can be stored electronically in a database and either selected by people from the database to represent their perceptions or combined into more complex pictures.

The technique enables a group to see what each member's perception of the problem is and what he or she would like in the future. Such a picture can very effectively show a vast amount of information, such as patterns, relationships and properties, and it can easily be shared with the other group members; all can see the problem in its entirety in a single glance. The following examples illustrate the use of rich pictures.

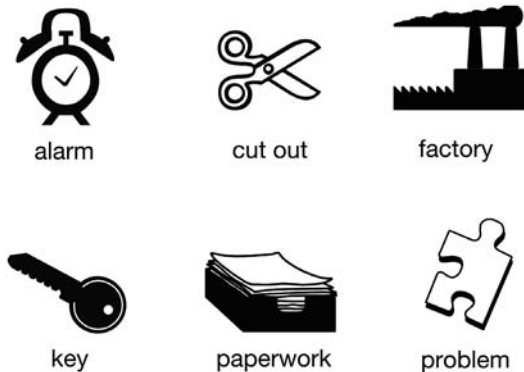


Figure 11.5

A problem in symbols

Example

A medical practice wanted to improve the way in which appointments were arranged. Telephone lines were jammed for up to two hours every morning with people wanting to arrange appointments, and queues of callers making appointments in person took up a lot of administrative time each day as well. A creative problem solving facilitator was employed to help come up with ideas on how to alleviate the problem. She asked the GPs to draw a picture of a city centre that depicted what they thought of the present situation within the GP practice. The facilitator then asked them to draw a picture of a city centre illustrating what they would see as the ideal practice. The first pictures showed a city centre cluttered with vehicles and pedestrians causing traffic jams and angry and frustrated people. These pictures represented a GP practice that lacked efficient modern communication channels with its patients. The pictures depicting the ideal situation, however, showed a city centre with pedestrian zones and well-laid out broad roads and pavements, permitting rapid transit from one area to the next, either on foot or by using modern trams. In addition, it had subways, fly-overs, an underground railway and even moving pavements in shopping malls and other heavily used areas. It was well served with road signs pointing the way for pedestrians and motorized travellers. The exercise took only a few minutes to complete and showed the GPs what they thought of the communication systems of the practice and how they would like them to change using modern technology. The drawings reflected the extent of the problem to everybody present very quickly, and suggestions such as using state-of-the-art communication technology – such as appointments by email or SMS texting through an automated intelligent Natural Language Processing interface – were put forward. In this way it was anticipated that people who had access to the new technology would opt to use it, thereby reducing congestion and allowing those who did not have such access to use the older conventional methods with less hassle.

Imagining

Highly creative people say that once they have an idea they attempt to make a clear and detailed picture of the final, implemented solution. Some songwriters, for example, create the album cover in their mind before composing the first song. Soccer players and skiers see themselves creating new moves over and over in their minds. Painters visualize the finished canvas. Whenever you have an idea, elaborate on it in your mind. Visualize it working in practice. Go through it over and over again.



- Ringmaster in a circus trying to get all and sundry to perform
- Flamboyant
- Has a whip
- Stereotyped figure
- Large teeth and big mouth
- Etc.

Figure 11.6

The ringmaster



- Different people dealing with same problem in different ways at different levels
- Deskbound
- Men
- Levels of authority
- Sleeves down
- Away from problem

Figure 11.7

Different people have different perspectives

Ideas

- Better communication among staff (big mouth and teeth)
- Training (the whip)
- Make it entertaining (circus idea)
- Change of environment
- Turn work into a circus
- Laugh about things
- See the funny side of everything
- Need a clown

Wishful thinking

This technique requires one to visualize a perfect future. Its aim is to make it possible for users of the technique to alter their perspectives on a problem and to establish goals for themselves that should be achievable. Used as a group creative problem-solving tool in conjunction with a facilitator the steps are as follows (Van Gundy, 1988):

- Step 1* Group members jot down a brief statement of the problem.
- Step 2* The facilitator then explains the technique with the aid of illustrative examples. It is also stressed to group members that in the course of the ensuing exercise they should always hold it in mind that anything is possible.
- Step 3* This is then followed by individuals within the group discussing with one another what the facilitator has told them so that they all have a definite idea of what they will have to do during the exercise.
- Step 4* Individuals then need to think up future orientated fantasy statements in the form of:
- in the future, it would be nice if we did . . .
 - what really needs to happen is . . .
 - if I were making decisions I would do . . .
- etc.
- Step 5* Group members then consider all the fantasy statements that have been generated – these can be listed on a flip board or entered into a computer and projected on a screen. They then have to try to develop ideas on how the thoughts expressed in the statements could be achieved. These too are recorded in a likewise manner on the flip board or the computer.
- Step 6* The more practical ideas are then linked back to the present problem situation. This might involve asking themselves how it could be done, or what mechanisms might facilitate doing it, or what might happen if it was actually done.
- Step 7* Previous steps can be repeated after restating the problem.

The technique really requires both the facilitator and the group to have had some experience of using creative problem-solving techniques since it is a difficult one to use. Fantasies can be difficult to develop into practical solutions.

Example

Step 1 Problem: delay in processing accident claims in head office of insurance company.

Step 4 In the future, it would be nice if we had more staff.

- What really needs to happen is fewer accidents.
- If I were making decisions I would settle all claims immediately.

Step 6 Settle all claims immediately.

- How it could be done? Have the district offices settle all claims without referring to head office for claims of less than £2000.
- What mechanisms might facilitate doing it? Training of district managers.
- What might happen if it was actually done? A few mistakes might be made but it would be a cost-effective approach.

Role playing

There are two approaches we will look at in this context, both of which require participants to use their imagination and change what they have into what they want.

The first involves imagining that you are another person who is involved in the problem or in its solution (Harris, 2002). If you are the person involved in causing the problem then you will need to ask yourself why you act in such a way and what causes you to do so. Subsequently, you will then need to think what it is that might improve your behaviour and in particular what personality quirks need attention. If you see yourself as the problem solver, then you need to consider what expertise you have – what you do and what you know.

SKYPE

In the not too distant past, long-distance communication by voice was accomplished with the aid of a telephone. Telephone companies worldwide made lots of money out of it. Phone calls from Europe to distant countries were often charged in pounds per minute and customers ran up large bills when they wanted to speak to their loved ones in far corners of the globe.

Things changed dramatically when Skype arrived on the scene. Instead of using telephone lines Skype has used Internet connections. This has reduced costs down to next to nothing. Moreover, not only can one speak to one's friends in this way, but one can also see them and even converse with a small group of people.

Indeed, the visual impact can be very important because one is able to show objects to one another in this way. A grandparent may have bought some clothes for a small child and will now be able to see the child wearing those clothes without even being in the same room.

Skype can offer many possible uses to business people. Can you make a list of these things?

Armed with the knowledge and experience you have, you need to imagine how you put this to good effect and solve the problem. In this case, you are making use of knowledge with which you are familiar and transposing it on to the problem in hand.

The second approach involves a mental metamorphosis. Here you imagine you are the subject of the problem itself – for example, an overcrowded motorway system. You would need to list all the attributes of the situations – for example, the effects of grouping in slowing down traffic flow, high frequency of accidents, expense and frustration caused to motorway users, etc. Next, you would ask yourself what it would feel like to be all these things and what action you would need to take in order to alleviate such inconveniences. This procedure is very much akin to that we described in the case of personal analogies in Chapter 10 (Synectics).

Creative problem-solving tools such as those discussed above can lead to highly profitable innovations, particularly where this involves producing disruptive technologies.

DISRUPTIVE TECHNOLOGY

Christensen (1997) describes disruptive technologies and their consequences. Paradigm-breaking ideas can produce disruptive technologies. Such technologies have an enormous impact on the marketplace. They often change markets quite radically, wipe out the market for existing technologies and create totally new markets that did not exist previously. They create benefits for some and incur costs for others. Disruptive technologies have to be created by those who benefit from them and anticipated by those who may suffer from their impact when they are introduced.

Examples of disruptive technology (current and historical) include:

- Digital cameras, which decimated the mass market for photographic film, but at the same time created markets for storage devices and photo printers.
- Railways, which dramatically reduced the traffic using other forms of transport such as stage coaches and canals. At the same time it had many social benefits (such as travel to distant places in a short period of time) and economic benefits (creating demand for labour, fuel, steel and other materials they needed). They also encouraged the emergence of new services such as trips to holiday destinations and the development of the hotel and boarding-house industries.
- Video recorders and televisions, which reduced cinema attendance. However, the film industry benefited from new income streams.

It can be very difficult to foresee the impact of a disruptive technology. Investors who do successfully see the impact of a disruptive technology can make an extremely good return on their investments. However, one does have to be aware of the possibility that in the case of disruptive technologies they could have implications even for a country's infrastructure. Brown (2013) notes the impact of the growth in the market for electric cars in the UK could put a strain on the capacity of the national grid.

Process innovation can also involve making use of a disruptive technology. This has been forcefully felt in the case of the travel industry. Booking travel tickets online has had an enormous impact on the industry. There has been a big movement towards customers booking online, creating severe difficulties for high street providers of this service.

QUESTIONS

- 1 Indicate how you would use vision building as a technique in solving different types of business problems. Are there any limitations? Explain.
- 2 Suggest how vision building might be employed in helping to sort out the strategic mission of an organization.
- 3 How might symbolic representation be used in a manufacturing company that wants to improve its efficiency in distributing its products to wholesalers and other distributors in the electrical white goods industry?
- 4 Rich pictures provide a method for gaining insights involving paradigm shifts. Draw up a list of problems which you think it might be useful to examine using this method.
- 5 Describe a visioning session developing: a nightmare competitor!
(Who could become one, what could they do, what's most horrifying about them, so what is it that makes them better competitors . . .)
- 6 Identify those issues in an organization that people might not want to discuss. Explain why this might be the case.
- 7 Have a list of possible major unexpected changes to an organization. They're possible but unlikely, for example:
 - Our stock triples over the next year (for a company expecting 4–5 per cent growth).
 - We merge with Girl Scouts.
 - Google buys us even though we're a men's clothing store.
 - Everybody wants to come to work for us.
 - Our customers boycott us.
 - We can make a successful business selling to only ten customers.

Discuss how each of these could come about.

- 8 See if you can use the Mendelev approach in getting ideas about problems of your own choice.
- 9 How might paradigm-breaking techniques such as the ones indicated in this chapter have helped bring about the paradigms shifts that are indicated? Looking ahead, can you think of any possible areas where paradigm shifts might possibly occur? Could any of the techniques be used to bring these paradigm shifts about? How?
- 10 Are disruptive technologies a good thing? Debate.

CASES

Airships

German and US stamps of the 1930s show various pictures of airships. They are even featured tethered to the top of a New York skyscraper. Airships were able to cross the Atlantic from Europe to America. Following disastrous accidents involving these craft and the development

of fixed wing aircraft capable of transporting many passengers and goods, airships declined in use and popularity after 1940.

The military use of airships has been spasmodic, but with the need for cost-effective persistent intelligence, surveillance and reconnaissance, interest has persisted. Speed is not of the essence and, indeed, an airship's ability to hover and remain stationary is a great advantage. Airships can also fly at a high altitude and endure long missions. They are most useful in the transport of heavy loads to harsh environments, like the Arctic territories.

Question

Many people might argue that while airships were a breakthrough innovation in their day, they were rapidly displaced by a newer invention the aircraft. As a result, their full potential was never fully realized. Today's market seems rather limited. Use wishful thinking to try to find some really paradigm-breaking uses for airships of the future. Critically evaluate the outcome of the exercise.

Problem solving with symbols

'Everything is in a mess. Orders are not sent out on time. There are too many accounts receivable overdue. We haven't enough secretaries in the typing pool. There is grumbling in the warehouse about overtime payments. Sales are declining and we have cashflow problems. All this, and now we have a product liability case on our hands.' The MD raised his hands in exasperation at his regular meeting with the chairman and the other directors.

'I heard Rumbles is entering the market with a new product. I bet it passed every standard there is,' the chairman sneered.

'Well, I feel that my time has come to resign,' the MD said solemnly. 'We probably can get out of this product liability mess by hiring a good lawyer, but I feel that I am not getting all the backing I need from my colleagues on the board and in the middle management ranks to enable me to keep the company on an even keel. It's true Rumbles are going to get a leg up with their new product. I can't see any way in which this company can match it. I have been saying for years that we need specialist marketers in the organization, as well as good R&D people. We certainly can create opportunities for ourselves, but we cannot market ourselves or our products and so exploit those opportunities to the full. Our distributors are fed up with the poor level of service we offer them. They expect us to advertise and pull the product through to their customers – but is that really our job? I've been grappling with this problem for years, and still we haven't got anywhere. Somewhere along the line there has been a loss of rapport with the middlemen.'

'I thought it was the MD's job to market the product!' the chairman exclaimed.

'It is certainly not a job for any of us. We don't have any sales experience.'

'Marketing isn't selling. How many times do I have to spell it out to you? We need marketers not sales people. We are in an industry where the customer is king and we have to serve the customers' interests. This is precisely what we are not doing at the moment. The R&D team think all they have to do is dream up some new ideas for improving products and everything else will take care of itself. As long as you put a rein on the expenses we can incur for staffing I cannot obtain a good marketing team.'

‘You have a budget. You can spend the money how you like!’ the chairman retorted.

‘But I can’t,’ the MD replied. ‘Most of the budget is spent on firefighting the problems created by the inadequacies of the previous budget. I am never in the position where I can actually say, “Now I can plan”.’

‘Stuff and nonsense,’ growled the chairman. ‘You have always had a free rein.’

Question

Construct a rich picture to illustrate the problems, threats, opportunities, etc. that appear to exist in the company at the time of the reported conversation.

A difficult problem

The leader of the town council and its chief executive had to find some kind of solution to the problem. The town’s population was some 30,000 and the most recent unemployment figures for the town showed that it now stood at just over 40 per cent. Never had either of them witnessed such figures as this in the town’s history. The worst figures were those for young people under 25 where it stood at 74 per cent.

In recent times shopkeepers had reported a considerable increase in the amount of shoplifting while at the same time sales revenue had dropped by 25 per cent on the previous year at that time. At least 20 per cent of the shops in the town centre were now vacant. In those that remained there was talk of a recent daylight robbery that had taken place. Beggars were appearing on the streets for the first time and many people avoided the town centre altogether after the first signs of dusk appeared.

The chief executive and the leader of the council pondered on what they might do. While the part of the population that appeared to be suffering most was largely concentrated in the close vicinity of the town centre, there was a more affluent community that lived along the hillside outside the immediate vicinity of the town centre. Most of these people enjoyed good incomes, although the younger members of families living there were mostly without jobs, too.

Questions

Can you think of any ideas as to what might be done to alleviate the situation, bearing in mind that no additional funding would be available from central government and community tax rise in the forthcoming round would be limited to 1 per cent below the level of inflation.

The floating motorway

The M62 motorway connects Liverpool with Manchester before continuing on its route eastwards over the moors to give access to Leeds, Bradford and eventually Hull. The stretch of the motorway between Liverpool and Manchester that crosses Chat Moss literally floats on top of a bog. All year round a procession of cars, vans and lorries of all sizes pound along the carriageway of the three-lane motorway in both directions for much of the day and night. The damage they cause is quite noticeable. The road surface develops bumps in it so that drivers start to experience a sensation like that caused to boats cutting through waves on the high seas.

Subsidence is a major problem on the road, and repairs are required from time to time as and when the experience of driving along the road becomes more dangerous. No one as yet appears to have come up with a lasting solution to this problem.

Question

Can you gain any insights into this problem?

When George Stephenson solved the problem of crossing Chat Moss with a floating railway line he established an idea that well over a century later would be adopted by builders of the M62 motorway.

FURTHER READING

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- Gassmann, O. and Zeschky, M. (2008) Opening up the solution space: the role of analogical thinking for breakthrough product innovation, *Creativity and Innovation Management*, 17(2): 97–106.
- Schwert, P. M. (2007) Using sentence and picture clues to solve verbal insight problems, *Creativity Research Journal*, 19(2/3): 293–306.

Miscellaneous ideation techniques

In this chapter we will review some of the remaining techniques of creative problem solving that can be used (the total number of techniques that could be addressed are well beyond the scope of this book to enumerate). The techniques we cover here are: Suggestion boxes, exhibits and competitions; Clichés, proverbs and maxims; Storyboarding; Scenario writing; Scenario day-dreaming; Bionics; Free Association; Two words; Story writing; Mind Map; Fishbone Diagram; Lotus Blossom Technique; TRIZ; Vision Building. Many other techniques are illustrated and discussed on various websites on the Internet and in other books written for the popular press. Many of these techniques are straightforward and would fit into MacFadzean's category of paradigm-preserving techniques. Some require more imaginative thinking and could lead to paradigm stretching or even paradigm breaking.

SUGGESTION BOX, EXHIBITS AND COMPETITIONS

Suggestion-box systems are usually slow in generating ideas but give everyone in the organization a chance to contribute. Employees provide suggestions either by using a special form or simply by writing ideas on pieces of paper and putting them into the box. One disadvantage of the method is that suggestion approval is subject to rather arbitrary decisions by managers who may not understand anything about the problem the idea is supposed to deal with. The biggest difficulty with suggestion boxes is not the concept, but how the concept is managed. The power of a suggestion box is enhanced by a quick and objective response.

Suggestion exhibits comprise a process whereby people can bring their suggestions, ideas and new inventions for all to see that the organization provides a display area and provides time for this purpose. It is most suited to a manufacturing or technically orientated company, but other kinds of business and organization might be able to use the system to advantage.

In the case of suggestion competitions, management asks departments or other organisational subunits to make suggestions. Each unit reports the number of suggestions they make and posts them each week or month on a wallchart in a public area. What is reported is the number of ideas. Names are not used. Variations include rewarding the best idea each month or week, or an award may be given to the group of people having 100 per cent participation.

CLICHÉS, PROVERBS AND MAXIMS

- 1 Select a proverb or maxim that has no obvious associations with the problem.
- 2 Note any interpretations or implications that the chosen phrase may infer.
- 3 Use the interpretations and implications in 2 to stimulate ideas with respect to the problem.

Suppose the problem concerns getting employees to be more positive in their attitude to adopting new working practices.

First proverb/maxim: If the shoe fits, wear it.

Implications:

- 1 Try a shoe before you buy it.
- 2 You buy a new shoe when your old ones are no longer fashionable or are worn out.
- 3 Buy a shoe which is of quality regardless of its price or label.
- 4 If a shoe does not fit, throw it away.

Interpretations:

- 1 Make sure people will respond to the company's needs by testing their suitability first.
- 2 Point out to people that they need to adapt to the changing needs of the times and that it is in their own best interest to do so.
- 3 Make sure that people adopt the new practices and then be prepared to pay the price whatever it costs to do so.
- 4 Sack people who are not cooperating and hire new personnel.

The key seems to be to recruit the people who find new methods challenging and interesting.

Example

PROBLEM: how to familiarize the company's staff with computers and make them more productive. STIMULUS: when the cat's away the mouse will play.

Interpretations:

- Mice are afraid of the cat.
- Why are the mice afraid of the cat?
- The mice play often.
- How far away does the cat go before the mice start to play?
- The mice take advantage of the fact that the cat is away.

Implications for the problem:

- Employees are afraid of computers.
- How can we reduce fear in the employees?
- When the boss is away the employees will play around and not try to familiarize themselves with the computers.
- Managers must encourage the employees to work with the computers.

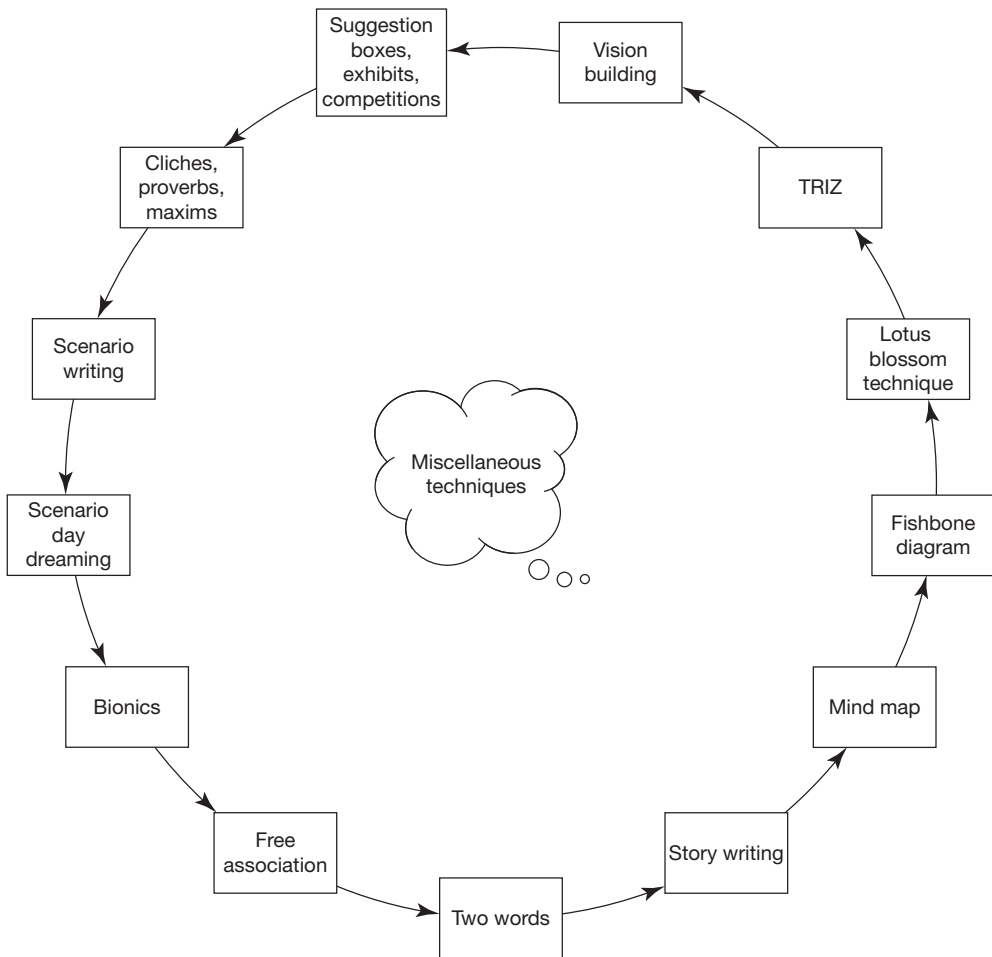


Figure 12.1

Chapter overview

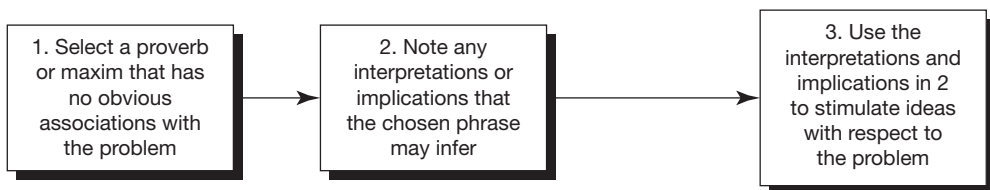


Figure 12.2

Clichés, proverbs and maxims

Ideas:

Provide games etc. to enable the employees to play with their computers and gain familiarity with them. This should dispel the fear.

Some degree of imagination and divergent thinking might enable the best to be got out of this technique. It is unlikely to produce any paradigm breakthroughs but might produce some paradigm stretching.

STORYBOARDING

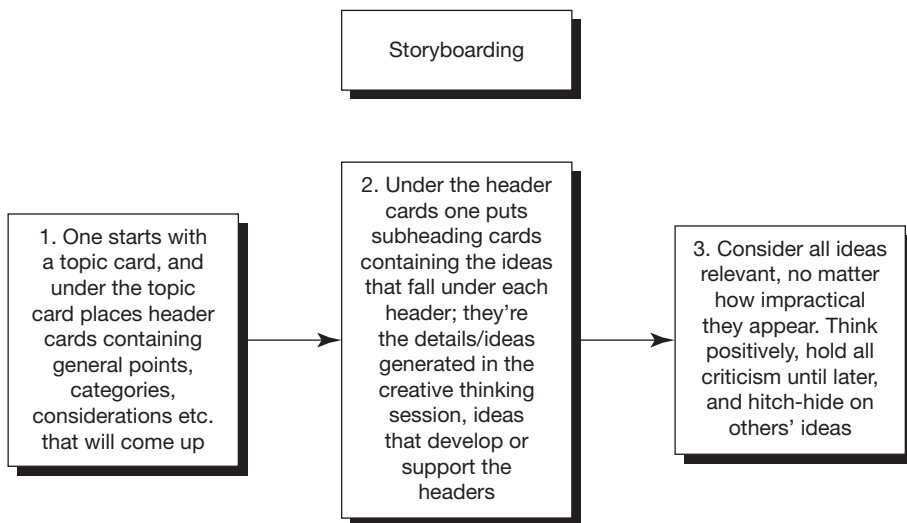


Figure 12.3
Storyboarding

Walt Disney and his staff developed a storyboard system in 1928 to help with cartoon animation. Disney wanted to achieve full animation, and for this he needed to produce an enormous number of drawings. Managing the thousands of drawings and the progress of a project was nearly impossible, so Disney had his artists pin up their drawings on the studio walls. This way, progress could be checked, and scenes added and discarded with ease.

Storyboarding is like taking your thoughts along with the thoughts of others and spreading them out on a wall as you work on a project or solve a problem. When you put ideas up on storyboards, you begin to see interconnections, how one idea relates to another, and how all the pieces come together. Once the ideas start flowing people ‘hitch-hike’ on others’ ideas. Software programs are now available such as Corkboard (Macintosh).

One starts with a topic card, and placed under the topic card are header cards containing general points, categories, considerations, etc. that will come up. Under the header cards one

puts subheading cards containing the ideas that fall under each header; they are the details/ideas generated in the creative thinking session, ideas that develop or support the headers.

Storyboarding works well in group sessions. There are four major types: planning, ideas, communication, organization, and storyboards. During a storyboarding session, consider all ideas relevant, no matter how impractical they appear. Think positively, hold all criticism until later, and hitch-hike on others' ideas.

The method requires a degree of imagination and can produce paradigm stretching.

SCENARIO WRITING

This is a tool developed and used originally in long-term planning and technological forecasting. It is a particularly useful method for speculating on the likelihood of new paradigm shifts.

Scenario writing is a method of looking ahead and forces an organization to be receptive to the need for change and creative thinking. It is an experience that involves considering new possibilities and opening up one's mind to consider what might happen.

The method involves all members of a team of coworkers and requires a leader or facilitator who introduces and coordinates sessions and who has the responsibility for producing a final report. Members of the team are referred to as scenario writers, and each member is usually an expert in his or her own field. One needs to make sure that there are experts in the group whose expertise is relevant to the problem under study. At the start of the exercise the scenario writers are briefed with the task of considering the developments in their area of expertise over the next 5–10 years. When they have done this individually they are brought together under the guidance of a leader to examine the situation collectively. Participants need to be reminded that they should be tolerant of the views of others because a consensus of informed opinion has to be reached.

The procedure adopted is as follows:

- 1 *Briefing.* Here the scenario writers are requested to consider what developments will take place in their area of specialization over the next 5–10 years. They are also asked to provide supporting evidence for this and to assess the likely impact of these developments on the organization.
- 2 *Individual scenario writing.* Scenario writers spend up to two weeks preparing their individual scenarios independently.
- 3 *Collective scenario writing.* Here the scenario writers meet up to present their individual papers and viewpoints and to reach a consensus viewpoint on possible developments. The output of the meeting is usually the report.

Scenario writing can be extremely useful and productive where the situation under review is a very complex one; it is, however, extremely time-consuming.

Although scenario writing is a formal procedure, it is still speculative in nature since it aims to predict the future of an organization, thus aiding the strategic planning process. The exercise can be conducted over a fairly lengthy time-period (say, two weeks), for its participants have to prepare a written report explaining their view of the future. The participants will be experts

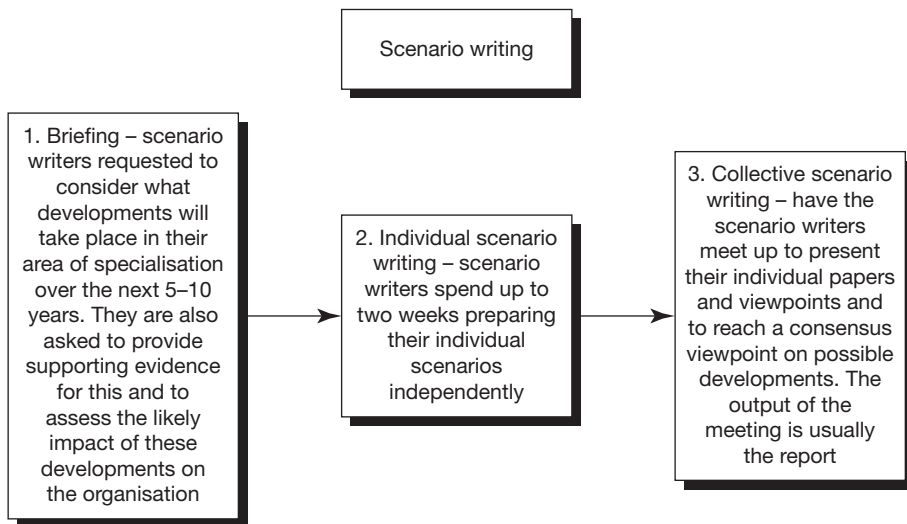


Figure 12.4
Scenario writing

on the various functions of the organization. The benefits of bringing together experts from various functions enable an integrated vision of the future to be examined with documentary evidence to support each argument. An awareness of the future environment (internal and external) and the change which may take place in it will provoke more creative responses to current situations.

SCENARIO DAY-DREAMING

Like scenario writing, this method also looks into the future and tries to assess the impact that trend will have on the organization. It is, however, less formal in its approach, and it is not the custom and practice to produce a report. It is usual for the entire process to take up only a couple of days and is an ideal activity for an ‘away-day’ venue, provided there are at least two away-days available.

Scenario day-dreamers are not expected to substantiate their contributions. The purpose is to stimulate people’s imaginations to think in the broader context and to consider more unusual ideas. A good group size is 8–10 people, but of course much depends on the size of the organization and the complexity of its business.

Again, there is a leader or facilitator whose role it is to plan the sessions in detail, advise on the selection of participants, brief the participants about the sessions, lead the sessions and help summarize the conclusions which are reached. Minutes of the session also need to be taken by someone. The procedure for the session is summarized below.

Preparation

The nature of the proceedings is explained. The scenario day-dreaming session described:

- 1 The session has to be divided into a beginning, a middle and an end.
- 2 It is helpful to have a warm-up session prior to the main session.
- 3 The first step is to identify the various factors that are likely to affect the future of the organization. These factors usually reflect aspects of the environment such as economic trends, cost of commodities, political and governmental policies, changes in demography, technology, social structure, consumer requirements and competitive activity.
- 4 The main factors should be summarized on a flip chart and possibly entered into a cross-impact matrix to indicate their importance.
- 5 Those present are then split into groups, and each group is given several of the factors to consider in depth and arrive at a future scenario for each of them. Group members should have the expertise to be able to scenario day-dream effectively for the factors they have been allocated. Roughly half an hour per scenario should be taken.
- 6 Groups should then reassemble to present their scenarios to one another. The entire group should discuss each scenario in turn and reach a common consensus.
- 7 All the scenarios presented should be integrated into a single comprehensive vision of the future.
- 8 Groups break into syndicates again and consider how the organization can respond to the opportunities and threats that are presented. Brainstorming and the use of the TOWS matrix (see Table 12.1) are useful tools to use at this point.

Table 12.1 *The TOWS matrix*

	<i>Strengths</i>	<i>Weaknesses</i>
Opportunities	Maximize on strengths and opportunities	Maximize on opportunities, minimize on weaknesses
Threats	Maximize on strengths, minimize on threats	Minimize on weaknesses, minimize on threats

The TOWS matrix presents a mechanism for facilitating the linkages between company strengths/weaknesses and threats/opportunities in the environment. It also provides a framework for identifying and formulating strategies. Opportunities, threats, strengths and weaknesses have to be identified and listed in the matrix. Next, various combinations of opportunities and strengths, opportunities and weaknesses, threats and strengths, and weaknesses and threats are examined in order to generate possible strategies. It should be observed that in generating strategies one seeks to maximize on strengths and opportunities, and minimize on weaknesses and threats. Brainstorming may be used effectively in helping to identify factors and generate strategies.

The whole group reconvenes, and the leader should review the proceedings, summarizing how the group sees matters and how the organization can try to meet future challenges.

SWOT ANALYSIS AND THE TOWS MATRIX

SWOT analysis is a technique specifically designed to help with the identification of suitable business strategies for an organization to follow. It involves specifying and relating organizational strengths and weaknesses and environmental opportunities and threats. In practice this is often an activity that is not carried out well. It is all too easy, having identified all the important points, not to know what to do with the data generated. Although intended as a mechanism to explain strategy rather than to facilitate its generation, the TOWS matrix (Weihrich, 1982) presents a mechanism for facilitating linkages and presents a framework for identifying and formulating strategies. Implementing the TOWS matrix requires that the following steps are followed:

- 1 Pinpoint and assess the impact of environmental factors – economic, political, demographic, products and technology, market and competition – on the organization.
- 2 Make a prognosis about the future.
- 3 Undertake an assessment of ‘strengths and weaknesses’ in terms of management and organization, operations, finance and marketing.
- 4 Develop strategy options.

Working systematically through this process enables internal and external factors to be entered on a grid and different combinations to be studied. For example, the entry to one cell of the grid could involve maximizing opportunities and maximizing strengths. This would amount to putting together at least one strength and one opportunity to produce a strategy that capitalizes upon this combination.

The Tows matrix

Product: plastic bags

Strengths	Weaknesses	
	1 Brand name	1 Exports
	2 Distribution	2 Sales force
	3 Low cost	
Opportunities		
1 Need for robust rubbish disposal bags	Use existing distribution and brand name to market scented bin liners (S1,S2, O3)	Strengthen sales force and export skills. Look to European markets (W1, W2, O3)
2 European markets		
3 Scented bin-liners		
Threats		
1 Substitute materials	Capitalize on brand name, distribution and low costs to meet competition from imports (S1, S2, S3, T2)	Develop capability in substitute materials particularly for products that can be sold to export markets (T1, W1)
2 Imports		

Any kind of organizational unit can benefit from this type of analysis as well as any situation that involves strategic decision making. Originally, Wehrich (1982) illustrated a conceptual application of the TOWS matrix to the strategic dilemma facing Volkswagen in the USA during the 1970s. His account demonstrated how the TOWS matrix could be used as a structuring device for analysing strategic problems. For the writer, this raised the interesting question of whether the use of the TOWS matrix could lead to the identification of appropriate strategies for an organization. In pursuing this question the writer has examined over fifty cases in which the TOWS matrix has been employed in commercial organizations. In all of these cases the users of the technique have felt that the method has enabled them to gain a deeper insight into the process of strategy formulation, has helped to structure their thinking and has often enabled them to come up with good new strategic ideas.

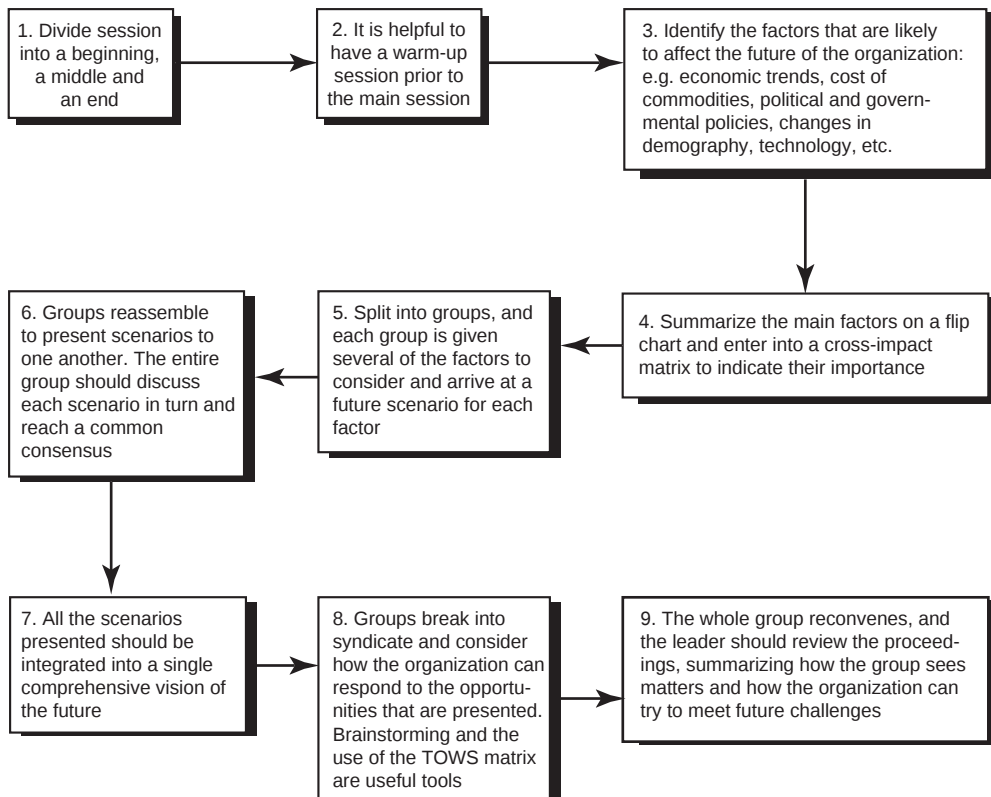


Figure 12.5

Scenario day dreaming

BIONICS

This is a special application of analogies and involves looking for stimulation in similar objects, products and processes. The search is usually restricted to examining biological and botanical systems using the argument that nature provides clues with regard to how to solve problems because it has itself solved many such problems.

Examples of where the method has resulted in useful applications include the Sidewinder heat-seeking missile (based on the temperature-sensing organs of a rattlesnake) and Velcro (based on the idea of burdock seeds which tend to cling to one's clothes if blown into contact with them – see pp. 48 and 167). The latter have minute hooks attached to them, and this is why they tend to cling to clothes. Velcro uses this same principle and provides a very effective fastening mechanism to supplement or even replace a zip or other fastener on clothing.

Nature, of course, does not always provide the right kind of guidance, so care has to be exercised in using bionics. Many years were spent trying to mimic the wing-flapping movements of birds before flight was eventually achieved using the principle of the fixed wing. Any technique featuring the use of analogies calls for some degree of imagination and is likely to result in paradigm stretching at least.

FREE ASSOCIATION

Of all the idea-generating techniques this is one of the simplest. One idea is used to generate another, which is then used to produce a third, and so on. There are two forms of free association.

- *Unstructured free association*

Here ideas are listed as they naturally occur and where one idea then leads to another. It is very similar to classical brainstorming.

- *Structured free association*

Here the procedure adopted attempts to increase the relevance of ideas to a problem. The procedure adopted is as follows:

- 1 A symbol – word, number, object, condition – that is directly related to the problem is drawn or otherwise recorded.
- 2 Whatever is suggested by the first step, whether or not it seems relevant to the problem, is recorded.
- 3 Step 2 is repeated until all possible associations have been listed.
- 4 Associations that seem most relevant to the problem are selected from the list.
- 5 The associations selected at stage 4 are used to develop and produce ideas that appear capable of solving the problem. If the first effort does not produce useful insights, it is repeated using another symbol as the starting-point – i.e. one recommences at stage 1.

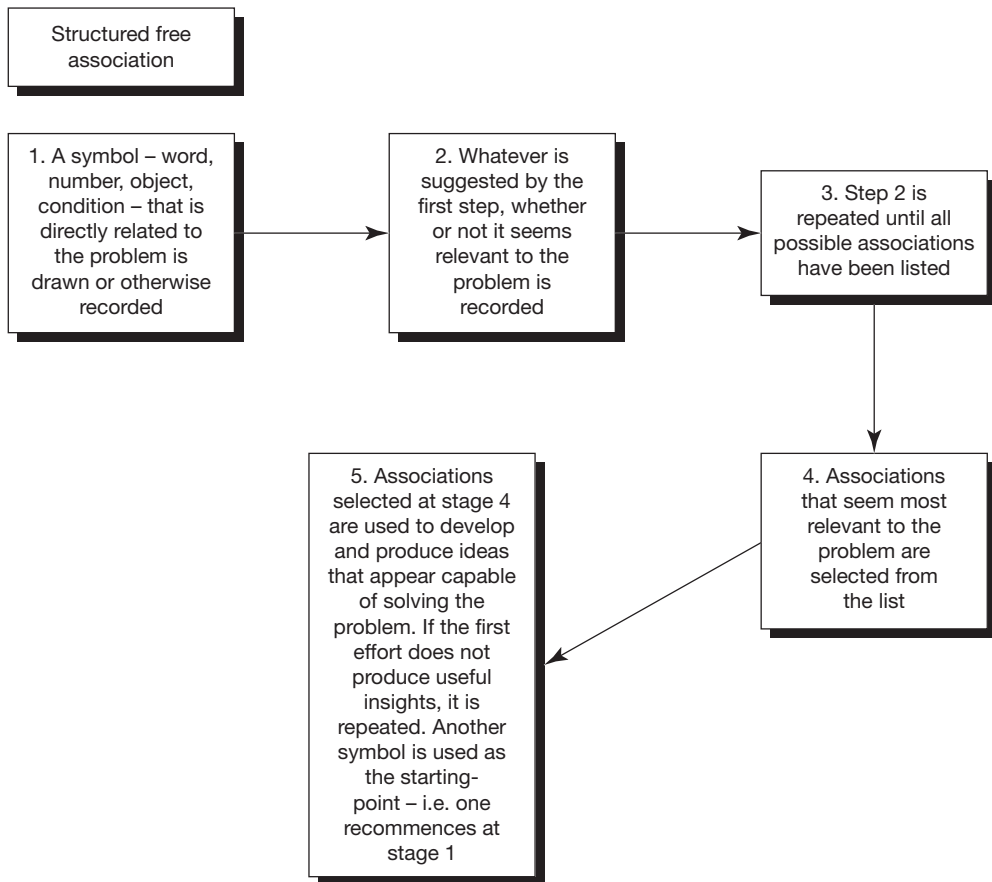


Figure 12.6

Structured free association

Example

A hotel wants to improve the facilities and services it offers to holidaying guests and is looking for ideas. It uses structured free association in the following way to gain new insights.

1 Stimulus word: history

2–3 Thoughts recorded:

- visits to local museums and art galleries
- tours of local historical sites
- films and videos about local history
- library of books and documents on history roundabout
- antiques and collectors' fairs
- displays

- 4 Antiques/collectors' fairs and displays
- 5 Hold weekly antique/collectors' fairs for the benefit of the paying guests and outsiders.
 - Also mount permanent displays of antique/collectors' items that might be of interest to visitors.

Free association can be used by anyone and can be used within existing paradigms. Like other techniques highly imaginative thinkers may be able to use the method to stretch or even break existing paradigms.

TWO WORDS

The two words technique employs forced relationships and related problem stimuli to generate ideas. The stimuli are obtained by examining different combinations of alternative descriptions of two keywords in the problem statement. The rationale behind this approach is that the phrasing of the initial problem statement may be limited in terms of its ability to provoke certain types of idea. By restating the problem using alternative meanings the technique will provide new perspectives that will give rise to new ideas. As suggested by Olson (1980), this involves the following steps:

- 1 Select two words (a verb and a noun) from the problem statement.
- 2 List alternative meanings for each of the keywords.
- 3 Select the first word from the first list and combine it with the first word from the second list.
- 4 Using this combination as a stimulus write down any ideas suggested.
- 5 Combine the first word from the first list with the second word from the second list and record any ideas suggested by this combination.
- 6 Continue combining words in the above manner until all possible combinations have been exhausted. Finally, different two-word combinations are examined for possible idea stimulation.

Example

How to ensure a high level of customer service:

- | | | | |
|---|---------------|-----|----------------|
| 1 | ensure | and | service |
| 2 | <i>ensure</i> | | <i>service</i> |
| | assure | | aid |
| | clinch | | assistance |
| | confirm | | help |
| | guarantee | | effort |
| | guard | | labour |
| | protect | | benefit |
| | safeguard | | utility |
| | secure | | wear |

- 3 assure aid
 assure assistance
 assure help
 etc.
- 4–6 – *assure assistance*: assure customers that the firm is always available to help with problems
 – *assure effort*: inform customers that the utmost effort will always be expended to ensure customer satisfaction, etc.

The major strength of the two-word technique is that it provides a variety of new problem perspectives – any one of which might prompt a high-quality solution. It is also very easy to use and takes up very little time.

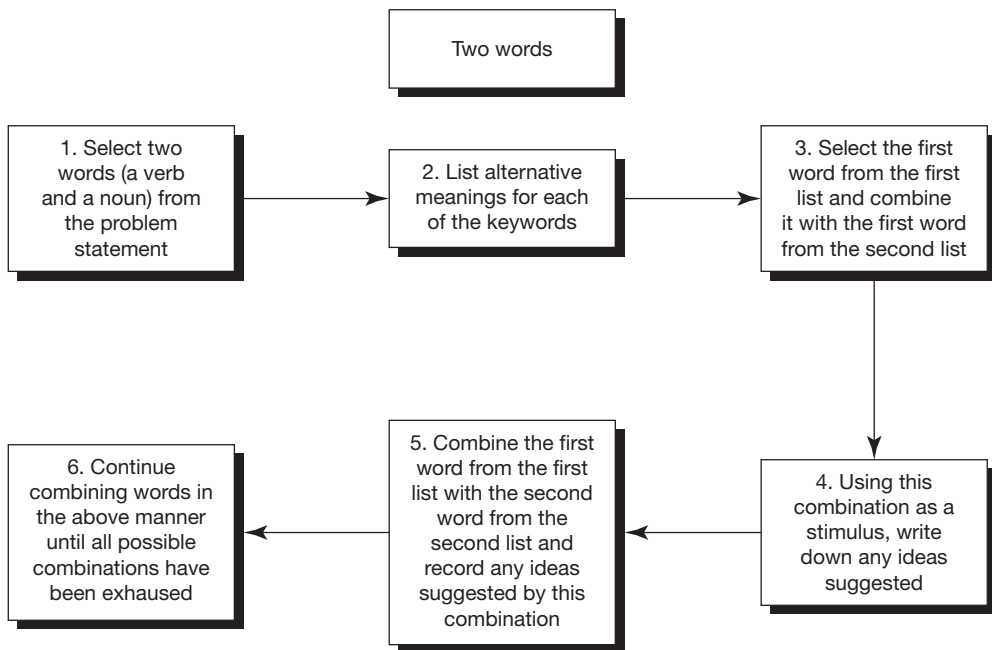


Figure 12.7
Two words

STORY WRITING

The technique, as the name suggests, involves writing a highly imaginative fictional story of, say, a few hundred words, and then relating it to the problem in hand. The story is then examined closely, and major principles, themes, expressions, thoughts, objects, etc., are listed separately. A long story can, of course, take considerable time to analyse for its relevance to a problem. On the other hand, a very short story may not be rich enough in ideas to stimulate thought with respect to the problem under consideration.

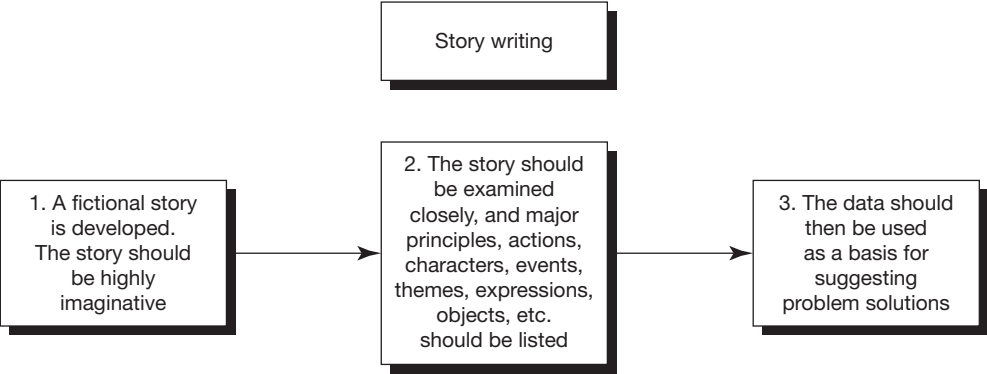


Figure 12.8
Story writing

The routine may be carried out in various ways. One such approach is the round-robin story and involves a group of people. Each member of the group contributes a line in the story-writing process. An alternative might be for one person to write the story, with the remainder of the group then working on its analysis and interpretation.

Example

PROBLEM

The firm in question produces alcoholic beverages and its position in the market has been threatened by changes in consumer tastes and a change in the taxation system, both of which have encouraged the entry of imported drinks. The firm produces traditional local drinks which are similar to whisky and brandy. The problem is that the firm feels that it has lost its competitive advantage and wants to regain its former position. It is not sure, however, what strategy it would be best to adopt.

THE STORY

Shading his eyes with his right hand, the colonel surveyed the distant mountains. He could just about pick out the unfamiliar narrow valleys seeming like tiny scars on the distant landscape. He observed his demoralized troops going about their routine chores drenched in sweat under the blistering sun. The town seemed quite close, glinting white through the haze, and as he watched he perceived an enemy soldier waving a white flag drawing near. He was a messenger from the town's mayor asking to meet the colonel because, as he said, they were tired of the siege. Before nightfall the colonel met the town's mayor and all was settled. Later, the colonel slept soundly. The plan of the battle lay on the table and by its side a bunch of flowers. The colonel had put his gun point next to the flowers as a sign of peace. He felt good when he awoke.

A TALL STORY

'If you are all sitting comfortably, I shall begin.' Andrea drew her breath.

'There was a gnome who lived not far from a railway bridge. The bridge was a dark and damp place, and people said that a troll named Zeino lived under the bridge. The gnome was a happy-go-lucky fellow and every day he would go to market on the other side of the railway line. He would not pass under the bridge, however, because he was afraid of the troll. People said that the troll was a horrible creature who used to eat all his victims alive and spit their bones at passing railway trains.

'One sunny morning the gnome set off for the market. He took a road through the woods, which led him to a level crossing over the railway. In that way he avoided the need to pass under the bridge. As he walked along, the gnome whistled a happy tune and thought about all the nice things he would see at the market. Just as he was about to reach the end of the clearing he heard the sound of running feet behind him. Turning round, he saw the most beautiful young woman that can ever have lived. She had fair hair and blue eyes and cried out to him to stop.

"'I am a fairy princess," she cried. "Please help me find my way home from this dark wood."

'The gnome stopped and said to the young woman: "Well, that is really very easy. All you have to do is follow me, for I am going to the market."

'At that moment, Zeino the troll appeared from behind a tree. He bared his teeth and chuckled: "Ah, ah! A gnome for dinner and a princess for supper. What a lucky troll am I!"

'But the fairy princess waved her wand, and behold it became a fire-breathing dragon. With one deep breath the dragon burned the troll to a cinder, and the princess and the gnome lived happily ever after.'

This short story can help in gaining insights into a range of different management problems. Storytelling, and relating the events in a story to the problem in hand, is one of a number of different methods that allow us to stimulate the imagination. In the above example we might ask ourselves 'What is the troll in our problem?', 'Who is the gnome?', 'What is the happy tune?', 'Who is the princess?', 'What is the fire-breathing dragon?' and 'What is the magic wand?' and so on!

SOME POINTS

- 1 demoralized troops
- 2 unfamiliar narrow valleys
- 3 a message from the mayor
- 4 asking to meet
- 5 tired of the siege
- 6 bunch of flowers at the gun point
- 7 plan of the battle

INTERPRETATIONS FOR IDEA GENERATION

- 1 demotivated sales force and other staff – need to find some way of motivating them;
- 2 need to explore new segments of the market which have been neglected until now;
- 3 should look out for those competitors who are in the same boat and who have been in the business for a long time;
- 4 need has arisen to make business alliance with competitors identified in 4, above;
- 5 find an appropriate opportunity to move ahead in the market when others have started to make mistakes;
- 6 long-term interests are the priority;
- 7 establish superiority in quality and special features of your products.

The firm eventually merged with a competitor which had good access to some of the market segments. Together they worked in marketing new brands, making an issue of the quality of the product and focusing on the purity of the water and special ingredients that were used to give it its own special flavour.

What other ideas might have come from the story?

MIND MAP

Mind maps can be drawn by hand, and this is the quickest way to perform the task. However, there are advantages in using mind mapping software. Mind mapping is a graphical means of taking or making notes. Graphical noting has been used since the dawn of humankind – early cave paintings and Egyptian hieroglyphics being obvious examples. In more modern times, process engineers and concept-orientated people have used flow charts and process diagrams to develop and explain their trains of thought and procedural flow.

The structure of the mind map allows for making intuitive associations, and capturing them within the 'notes' structure. Mind maps use a central image to connote the overall theme, keywords, colours, codes and symbols. Buzan (1994), who synthesized graphic noting techniques and evolved them into modern mind mapping, writes:

The Mind Map can be applied to every aspect of life where improved learning and clearer thinking will enhance human performance. The Mind Map has four essential characteristics:

- (a) The subject of attention is crystallized in a central image.
- (b) The main themes of the subject radiate from the central image as branches.

- (c) Branches comprise a key image or keyword printed on an associated line. Topics of lesser importance are also represented as branches attached to higher level branches.
- (d) The branches form a connected nodal structure.

(Buzan, 1994: 59)

Gelb (1988) offers seven guidelines to effective mind mapping:

- 1 Start the map by drawing a picture of the topic in the centre of the paper.
- 2 Use keywords.
- 3 Connect the words with lines radiating out from the central image.
- 4 Print the keywords.
- 5 Print the keyword per line.
- 6 Use colours, pictures and codes for emphasis.
- 7 Free-associate, then organize.

To appreciate why the mind mapping process works as well as it does, one has to go back to how the brain functions. The left side of the brain has been shown to process information in a linear/sequential fashion, analysing the various parts that make up the whole. The right side of the brain, on the other hand, processes concepts, patterns and relationships. The right side synthesizes while the left side analyses.

Mind mapping uses both sides of the brain. It allows the mapper to build out ideas by expanding the branches. Entering new ideas is as easy as adding another branch to either the central theme or one of the other main branches. Information presented later in the discussion or book can easily be related to a concept that was developed early in the programme by extending the branch. Once completed, the mind map presents the concepts and relationships, along with the keywords that will trigger memory.

One of the central concepts of mind mapping is the use of keywords. Keywords are the seeds of intuitive association. They are easy to create, and much easier to remember and recall than full sentences. The use of keywords also forces our creative brain to add the context (the rest of the story) to the keyword – in its own words or pictures. The emphasis must be on concepts and not on isolated facts. The use of keywords can help us to conceptualize. Keywords tend to be strong nouns or verbs. They are words that evoke strong images that can trigger our contextual recall.

Buzan (1991) writes:

Every word is ‘multi-ordinate’, which simply means that each word is like a little centre on which there are many, many little hooks. Each hook can attach to other words to give both words in the new pair slightly different meanings. For example the word ‘run’ can be hooked quite differently in ‘run like hell’ and ‘her stocking has a run in it’.

Rustico (2007) notes that the solution to difficult problems could require a variety of different approaches, including some of the methods indicated in this book. He also illustrates how mind mapping can greatly assist the implementation of these methods or techniques. Below in Figure 12.9 we show how a mind map can be used combine *check listing* with *brainstorming* to produce ideas/insights with respect to holidays.

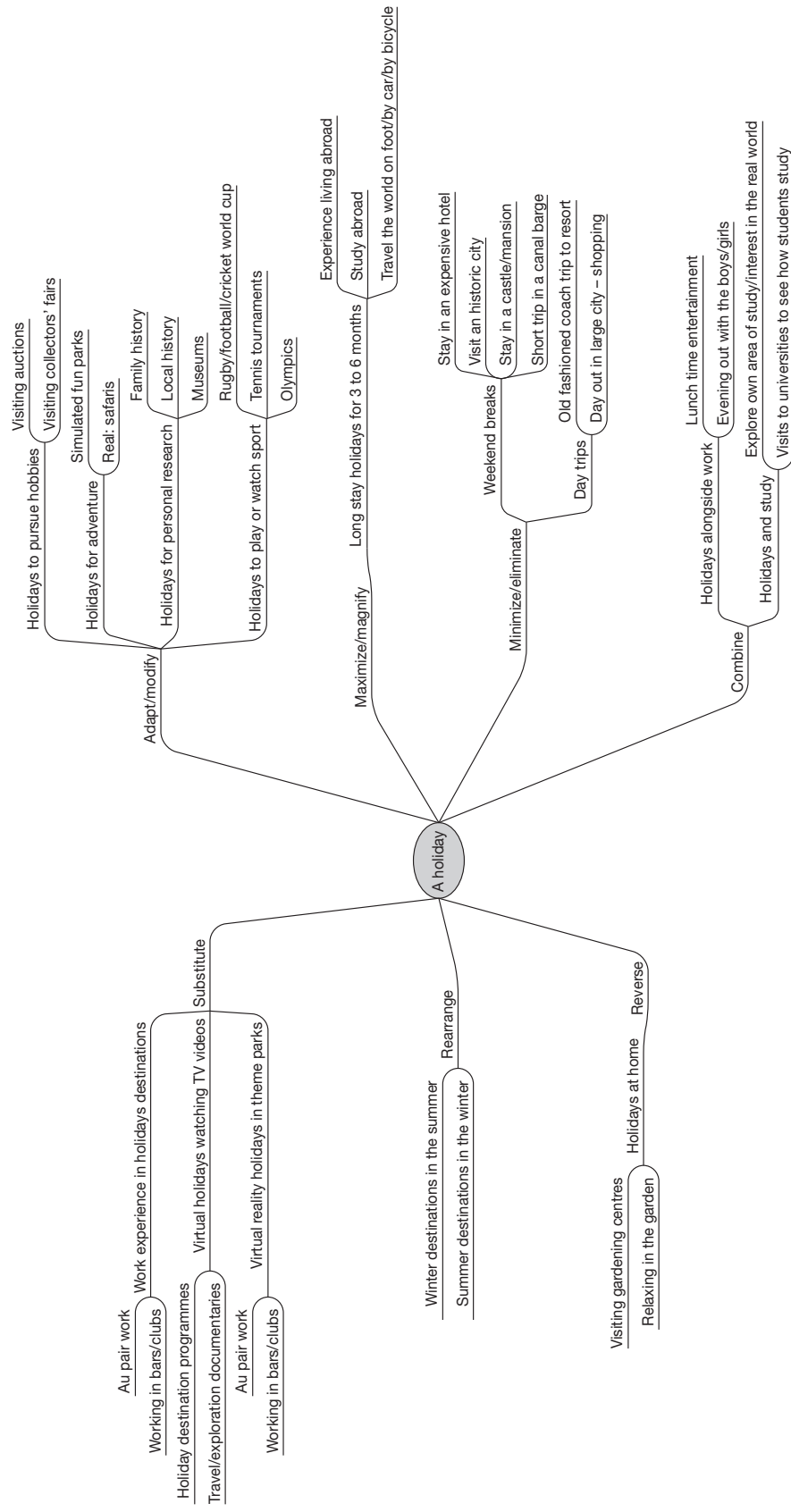


Figure 12.9

Using mind maps to combine checklists with brainstorming

Fishbone diagram

The fishbone diagram was proposed by Professor Ishikawa of Tokyo University (Majaro, 1991). The diagram depicts all possible causes contributing to a problem, or can be used as shown in the illustration to depict all factors relating to a problem or concept. The shape of the diagram resembles that of a fishbone structure – hence its name.

To draw the diagram one first places the problem under consideration (or the topic of interest) at the 'head' end. All possible causes of the problem or principal features of the concept are inserted at the end of the bones and at 45 degrees to the backbone. Further breakdowns of the causes or features are listed on additional branches running off those already inserted at 45 degrees to the backbone.

Having completed the diagram, the group uses it as a discussion vehicle, and it is customary to consider the points that are raised in ascending order of complexity, starting with the simplest relationships.

In the example diagram (Figure 12.10) we see that the concept under study is the design for a new car. The diagram picks out the main features of the car and indicates the specifications for each feature. Of course, in practice such a diagram would be much larger and contain many more features and their corresponding specifications.

The fishbone diagram encourages one to look at every aspect of a problem or a topic of interest and to highlight the various relationships along with the relative importance of its various parts. It also helps to establish a logical sequence for handling various parts of a problem in a systematic way and enables one to visualise the parts within the whole.

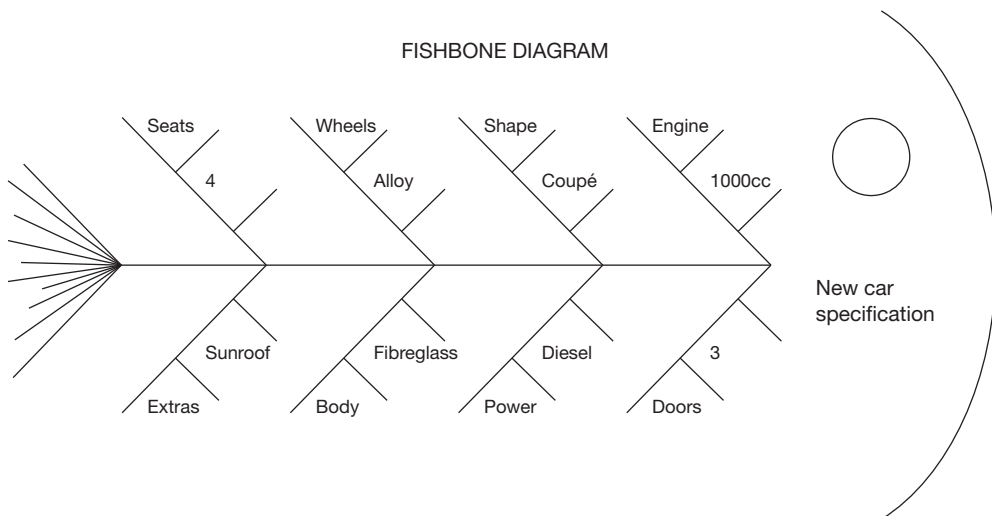


Figure 12.10
Fishbone diagram

Lotus blossom technique

This method starts with a central theme or problem and works outward, using ever-widening circles or 'petals' (shown as stars in Figure 12.11). Central themes lead to ideas that themselves become central themes, and so on. The unfolding themes trigger new ideas and new themes.

- 1 Copy the diagram shown in Figure 12.11.
- 2 Write your central theme or problem in the diagram's centre.
- 3 Think of related ideas or applications and write them in the surrounding stars. For instance, one company's central theme was 'establishing a creative climate'. They surrounded this statement in the central box with: 'offer idea contests', 'create a stimulating environment', 'have creative-thinking meetings', 'generate ways to "get out of the mould"', 'create a positive attitude', 'establish a creative-idea committee', 'make work fun', and 'expand the meaning of work'.
- 4 Use the ideas written in each of the eight surrounding stars as the central themes for another eight ideas. (New layer of stars not shown in Figure 12.11)

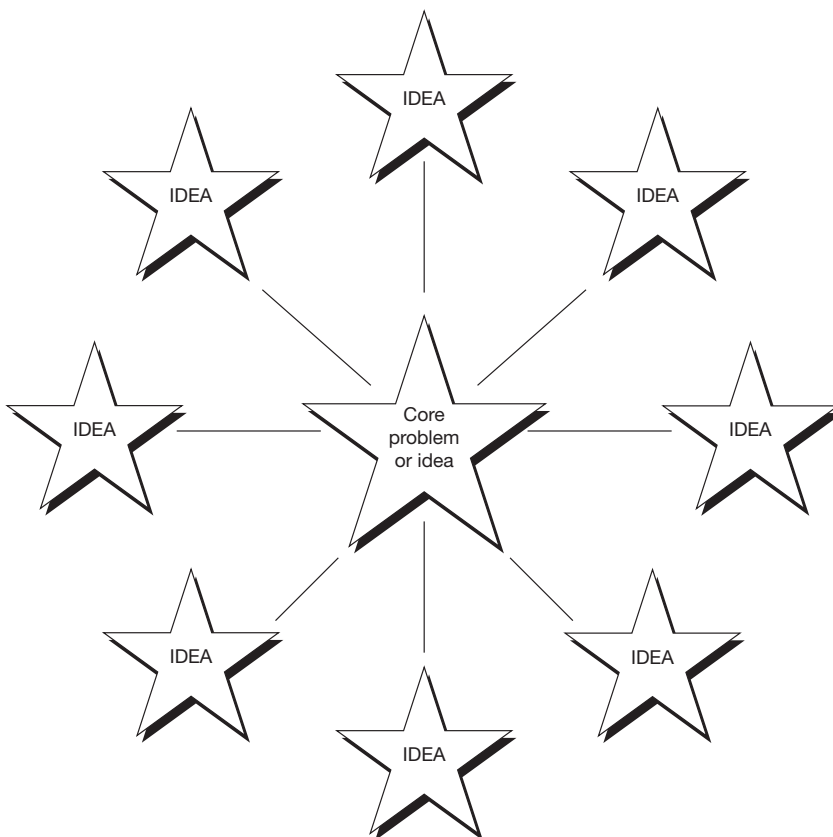


Figure 12.11

The lotus blossom method

- 5 Try to think of eight new ideas involving the new central theme, and write them in the stars surrounding it. Use the idea stimulators to help you generate ideas. Fill out as many stars as you can.
- 6 Continue the process until you've completed as much of the diagram as you can.
- 7 Evaluate the ideas.

TRIZ

TRIZ is a series of creativity triggers that assist one to see problems from different angles, hone in on the real underlying problem and come up with possible solutions. TRIZ has 40 Inventive Principles that provide innovators with a means of breaking out of current paradigms into new ones.

Set in a business context, the principles exhibit a number of similarities and differences relative to their use in technical problem solving applications. To use these 40 Inventive Principles, one has to formulate the problem using the same methods used for TRIZ for technical problems.

It will be particularly helpful to formulate the ideal final result and the reasons that the ideal cannot be achieved. This will usually lead to contradictions. For example, in a decision-making situation, the ideal final result is 'everyone is always satisfied with the decision'. The analysis might follow this path:

- 'Satisfaction of everyone is not always possible'.
- 'Why not?'
- 'Because there are too many interests to consider'.

This analysis reveals a potential problem and a pathway to solution:

- Everyone may be satisfied provided that their interests can be taken into account.
- Next, one uses the 40 principles to look for a solution to the problem.

Below we consider examples of the use of seven of the principles (or constituent elements) in connection with approaching the above problem.

Principle 1: Segmentation

Divide an object into independent parts.

Identify various ways of satisfying different groups of individuals.

Principle 2: Taking out

Separate an interfering part or property from an object, or single out the only necessary part (or property) of an object.

Identify and highlight key compromise or satisfaction issues.

Principle 3: Local quality

Make each part of an object fulfil a different and useful function.

Show how what the organization wants to do is congruent with the individual wants of all or most interested parties.

Principle 4: Asymmetry

Change the shape of an object from symmetrical to asymmetrical.

Alter the proposed action so that it seems to benefit most or all interested parties.

Principle 5: Merging

Bring closer together (or merge) identical or similar objects, assemble identical or similar parts to perform parallel operations.

Stress the overlap of the wants and needs that one seeks to serve and reconcile.

Principle 6: Universality

Make an object or structure perform multiple functions; eliminate the need for other parts.

Show or argue that by taking a single course of action one can eliminate the need for other costly undertakings.

Principle 7: 'Nested Doll'

Make one part pass through a cavity in the other.

Show how satisfying the needs of one or more groups helps to satisfy unsatisfied needs of other groups.

VISION BUILDING

Vision building has become an effective means for individuals and organizations to set and achieve goals. The vision is believed to reinforce and reorientate efforts to create and achieve organizational goals (Parker, 1990; Saxberg, 1993). Forsth and Nordvik (1995) describe a method for building visions in organizations. An important aspect of this method is that communication is achieved through visual pictures. They suggest that one needs to build up a 'picture language' comprising not fewer than 50 and not more than 200 pictures. The pictures should evoke pleasant feelings rather than unpleasant ones. Roughly 25 per cent of the pictures used in a session should relate directly to the kind of vision being built. Examples include people working or playing together, or animals/flowers (these symbolize the organization). Another 25 per cent might represent emotional states that are relevant to the vision – pictures symbolizing happiness, stability, change, etc. Yet another 25 per cent of the pictures should be highly stimulating – pictures using strange colours, unusual forms or even amusing pictures. The final quarter should comprise a mixed bag of pictures of all kinds. Photographs and artwork may be used.

In essence, a group of individuals from an organization are invited to browse the pictures and see if they can relate the symbolism of whichever pictures take their fancy to their own organization. Through subsequent group discussion in which they share their own experiences of the pictures, they are able to create a group vision for the company.

QUESTIONS

- 1 Imagine you have the task of managing the production of one of Gilbert and Sullivan's operettas. Use the technique of storyboarding to record your ideas on planning, organizing and communicating your ideas on the production to all parties who will be associated with the project (i.e. participants, sponsors and potential audiences).
 - 2 Evaluate the usefulness of bionics as a means of generating insights. Provide some illustrations of how it might be applied on different kinds of problem.
 - 3 What is free association? Illustrate how it might be used in helping to come up with solving water-shortage problems during the summer or dry season.
 - 4 Construct a fishbone diagram to sketch out the relevant factors impinging on a problem of your choice.
 - 5 Show how you would apply the technique of clichés, proverbs and maxims in coming up with insights concerning the following problems:
 - (a) How to improve efficiency in the warehouse.
 - (b) How to reduce lost time through accidents in the office.
 - (c) How to make the most of the time available in meetings.
 - (d) How to reduce the impact of organizational politics on decision making.
 - (e) How to avoid making major errors when setting down policy.
 - 6 When might an organization use scenario writing? What are its major limitations?
 - 7 Evaluate the usefulness of the kind of things that is suggested by TRIZ as a creative problem solving technique for business management.
-

CASES

Universal creativity

It is 3575 and the Androids have taken over control of all commercial enterprise on the earth and in most parts of the universe which has been explored to date by mankind and other intelligent life-forms. Androids run all the businesses and all intelligent life-forms enjoy an existence of enforced idleness and pleasure. Disease has become a thing of the past and most earthling beings now live to at least 110 years of age. Moreover, poverty as it was known in the nineteenth, twentieth and twenty-first centuries on earth has disappeared. Affluence abounds everywhere and all human beings have a standard of living at least equivalent to the very richest people in the twenty-first century on earth.

The Androids are looking for ways to provide new entertainment for human beings and other intelligent forms on distant galaxies. Time travel is now possible, though it has only been experienced by relatively few intelligent beings who live on the planet A6183 in Galaxy 918. In addition, instant means of transportation over distances of thousands of light years has been made possible during the last decade as a result of new technologies.

Question

Can you think of any ideas that might be helpful for the Androids in their search for new ways to entertain intelligent life-forms throughout the galaxies?

Hillchurch Council

Hillchurch Council is faced with the problem of how to cope with on-street parking problems and traffic congestion in the town centre. Originally, a bypass was approved for the town, but successive national governments have repeatedly delayed giving their support for the scheme, and at present the prospect of a bypass seems to have receded altogether.

Recent improvements to the town centre have included the opening of a large superstore and the development of a high-class shopping precinct. In addition, a new college of further education has opened up to serve the local community. All of these factors have led to an increased demand for parking space, and this has only been achieved at the expense of on-street parking in neighbourhoods surrounding the town centre. Not only has this led to an increase in complaints from residents, but it has also substantially increased the risk of accidents on the roads and increased congestion in the town. Indeed, many of the streets that originally were available for parking have now had to be painted with double yellow lines to prevent parking and hence reduce the risk of serious accidents. There are no plans to build new car parks and there is no new space available for the building of car parks. At present there is one car park which can accommodate 50 vehicles and two which can accommodate 100 vehicles each. None of these sites is suitable for development as a multistorey car park.

On market days (two days a week) and Saturdays the situation in the town is chaotic. Moreover, the situation is made much worse in the summer when travellers to a nearby seaside resort come through the town in their thousands. Hillchurch is a veritable bottleneck straddling main north–south and east–west routes. Furthermore, only one major road runs north to south through the town and only one runs east to west.

The town's sole traffic warden is hard pressed to keep up with the numerous complaints that are made daily but, despite requests made for additional wardens, the council feels that providing more wardens will do little to alleviate the dreadful problems that exist. The leader of the council feels that this is a problem that requires some creative insights and has approached a firm of management consultants to help with the problem. The consultants have indicated that they feel their expert on lateral thinking may be able to help with this particular problem and have assigned the task accordingly.

Question

Use story telling in order to get some insights in to the problem.

The conference

John is organizing a creativity and innovation conference to be held in Brussels. It is very important that he records all the things that he has to do, but, inevitably, when he draws up lists of things to do he leaves important things out. He is expecting over 500 delegates to the conference, which he plans to hold at one of the city-centre hotels. In addition to the actual conference itself there is the matter of guest speakers to sort out, plus their transport from different parts of the world – not to mention their accommodation. Many of the guest speakers require special equipment, such as large-screen TVs, video-player, computer and projection panel, as well as the basic things like flip charts, markers, overhead projector, etc. Then there are the meals, the paperwork, the bound copies of the proceedings and, of course, the helpers who are going to make the conference run smoothly.

John does not know where to start, but someone has told him that mind maps can be very useful in such an instance.

Question

Produce a mind map of the kind you think would be helpful to John in this instance.

What to do with all the glass

After 20 years working with his business partner setting up a highly lucrative hi-tech business John is now free to do anything he pleases. The pair sold the business to a larger company for £10 million. John has moved house from the city into the country. He has acquired a smart house with 4 acres of arable land. In addition there are stables, a two-storey outbuilding that is suitable for offices and some 40,000 square feet of greenhousing. At 50 years of age John still has the urge to get involved in setting up a business. However, he is somewhat at a loss to know what to do with the various assets he has recently acquired.

Question

Can you come up with any ideas?

FURTHER READING

Jamali, K. and Hashm, S. M. (2010) Managing projects through the theory of inventive problem solving (TRIZ), *International Research Journal of Finance and Economics*, 44.

Rustico, E. (2007) Mindmapping applied to problem solving, Turku University Computer Science CONNET: Communication Networks and Human Technology, 15 February.

Evaluation

Rating and evaluating ideas

A publisher is reviewing the recurrent problem of how to market books. Two thoughts have been put forward. On the one hand, more effort could be put into employing additional sales representatives to call on universities and colleges or, on the other hand, efforts could be directed towards developing and marketing a website. There are various ways in which such ideas could be evaluated. We could try to evaluate the likely financial effectiveness of the two approaches in terms of generating extra revenue and choose the option or possible combination of the two options that will produce the highest expected financial pay-off. However, relying on such an approach alone may be unsatisfactory because of the uncertainty surrounding the financial costs and benefits associated with the two options or their various combinations. An alternative might be to consider non-financial criteria in addition to financial criteria. For example, we could determine a set of non-financial criteria and evaluate each idea against the criteria on a scale of, say, 1–10 (10 being 'good' and 1 being 'poor'). Such criteria might reflect such factors as how good the option is at increasing such things as awareness, interest, knowledge, etc., of the publisher's products and services. Of course, as with all rating scales, complications then arise as to how one weights the different criteria since some may be considered to be more important than others.

Rating scales and financial costs and benefit analyses are not the only ways of evaluating options. A more qualitative offering to the problem is also possible. This is provided by reverse brainstorming. Here we would list the options available and brainstorm the difficulties that might be associated with implementing each one of the options available. Then we would look at problems identified and try to come up with possible solutions to these problems. In this way we would be able to identify the practicability of implementing each option in addition to the financial costs and benefits that have been estimated to be associated with that option.

How does one decide that one idea is better than another? What criteria does one use to make such evaluations? How does one equate one thing with another? These are some of the key issues to consider. For example, two projects offer different financial benefits, so should one consider the one with the better financial prospect? What about risk? What about non-financial benefits? How does one measure many of these things? Are some of the criteria more critical to the success of the project than others? All these kinds of things have to be taken into account when evaluating projects or ideas.

INTRODUCTION

Having covered the methods of ideation in the previous chapters we now move on to looking at decision making – deciding whether or not it is worthwhile taking any ideas that have been generated any further. Methods of evaluation range from simple checklists to complex weighted scoring systems. First, however, we look at sorting methods before turning to look at evaluation methods. Many of the ideation methods we have examined in the previous chapters produce a large quantity of ideas. Before we can evaluate these ideas we need to sort them into categories or themes. This facilitates the process of making comparisons and evaluations. Finally, we give some thought to exercising choice. We look at a number of methods: advantage–disadvantage tables, Plus and Minus Interesting (PMI), Castle technique, Sticking dots, Creative evaluation, Weighting systems, reverse brainstorming, financial evaluation, mathematical evaluations, Pay-off tables and Decision trees. We also look at Naturalistic decision making and Strategic framing. While decision making is important in this context we

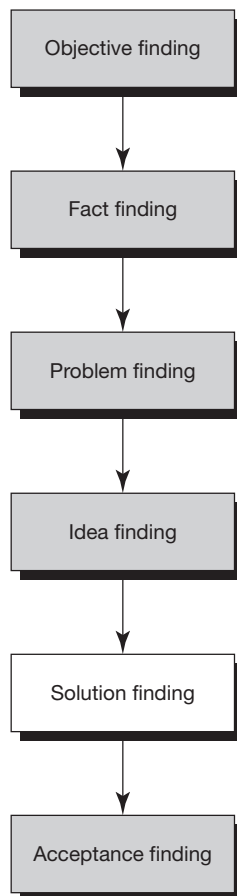


Figure 13.1

Position of the chapter within the CPS process

still have to consider the question of how decisions are implemented, which is the topic of the last chapter.

SORTING

An individual was asked to brainstorm ideas for the use of aluminium foil. These were first written down on a sheet of paper. Ideas were then examined for those that looked interesting (*highlighting*), and the remainder were discarded. The remaining ideas were then grouped according to different *hotspots* or *themes*. An idea could be appended to more than one *hotspot* or *theme* (indicated by the entries in brackets).

- 1 *Cooking*
 - 1.1 covering roast chicken
 - 1.2 wrapping baked potato
 - 1.3 covering food for storage
 - 1.4 milk-bottle tops
 - 1.5 wrapping food for storage w/o fridge
 - 1.6 keeping food warm
 - 1.7 lining a grill pan
 - 1.8 wrapping sandwiches to keep fresh
 - 1.9 lining cake storage tins
 - 1.10 (cooking food on campfire)
 - 1.11 reflecting heat source
 - 1.12 keep food cold
- 2 *Fun*
 - 2.1 baby's rattle
 - 2.2 screw up to make ball
 - 2.3 making a cat's toy
 - 2.4 stepping stones
 - 2.5 flapping fish game
 - 2.6 (water in Brownie pool)
 - 2.7 (making children's jewellery)
- 3 *Practical*
 - 3.1 making a cup
 - 3.3 smooth to make a mirror the CPS process
 - 3.4 lining wall behind radiator
 - 3.5 glue/paint dish
 - 3.6 temporary curtains
 - 3.7 (wrapping buttonhole stem)
 - 3.8 (cutting strip to make bookmark)
 - 3.9 (make milk-bottle tops)
- 4 *Camping/out of doors*
 - 4.1 reflecting sunlight for SOS
 - 4.2 lining under sleeping-bag

- 4.3 wrapping food on campfire
- 4.4 keeping matches dry
- 4.5 (keep food warm)
- 5 *Decorative*
 - 5.1 wrapping buttonhole stem
 - 5.2 Christmas decorations
 - 5.3 use in collage
 - 5.4 water in Brownie pool
 - 5.5 making children’s jewellery
 - 5.6 cutting strip to make bookmark
 - 5.7 gift-wrap 25th-anniversary presents
 - 5.8 (smooth to make mirror)

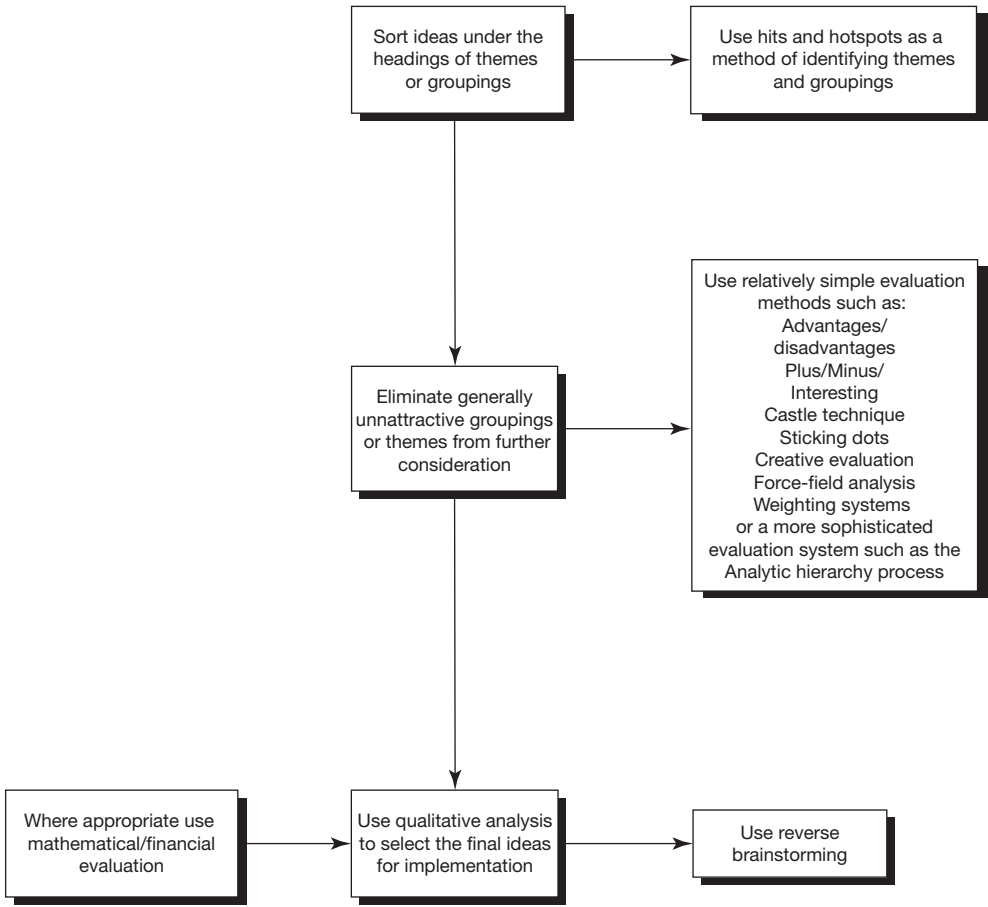


Figure 13.2
Overview of the process of sorting and evaluation

To help group the ideas, five columns were drawn up on a piece of paper and each column was headed with the title of the *theme*. Ideas were then listed as appropriate under each column heading, thus:

<i>Cooking</i>	<i>Fun</i>	<i>Practical</i>	<i>Camping/ out of doors</i>	<i>Decorative</i>
ideas	ideas	ideas	ideas	ideas

The next stage involved evaluating the hotspots or themes before analysing retained ideas (one or other of the methods described below can be used to evaluate themes or hotspots). Interesting hotspots are retained so that the ideas within the hotspots can be individually evaluated.

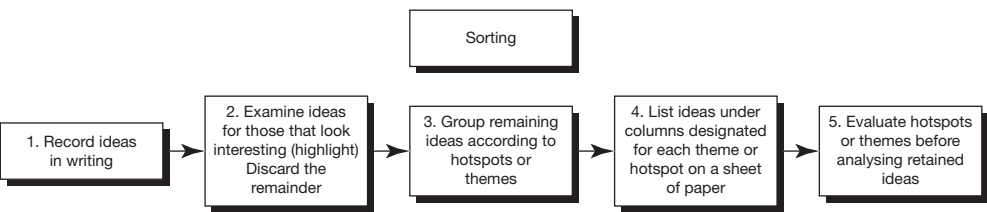


Figure 13.3
Sorting

EVALUATION METHODS

The following methods may be used to evaluate all the ideas that have been generated along a particular theme or grouping, or to evaluate/eliminate particular themes or groupings.

Advantage–disadvantage tables

Perhaps the simplest method of evaluating ideas makes use of tables that permit the comparison of the advantages and disadvantages of various ideas. For example, suppose there are two ideas about how we should reorganize the office – method A and method B. First we list the criteria against which we want to compare and evaluate the ideas. The same criteria are used for both of the options, and space is left to indicate whether the idea was rated as having predominantly advantages or disadvantages when considered against those criteria.

The technique is useful as a rough evaluation tool, and in the example in Table 13.1 it will be noted that method B seems to have the better rating. However, except for possible use as a preliminary screening device, this approach has too many limitations. Its main weakness is, of course, that it assumes that all the criteria carry equal weight and that it is the overall score that is important (it overlooks the fact that some of the criteria may be critical – i.e. they must be satisfied).

More elaborate screening methods have been suggested by Hamilton (1974). The methods involve ‘culling’ ideas that fail to satisfy key criteria, and rating and scoring ideas against desirable criteria.

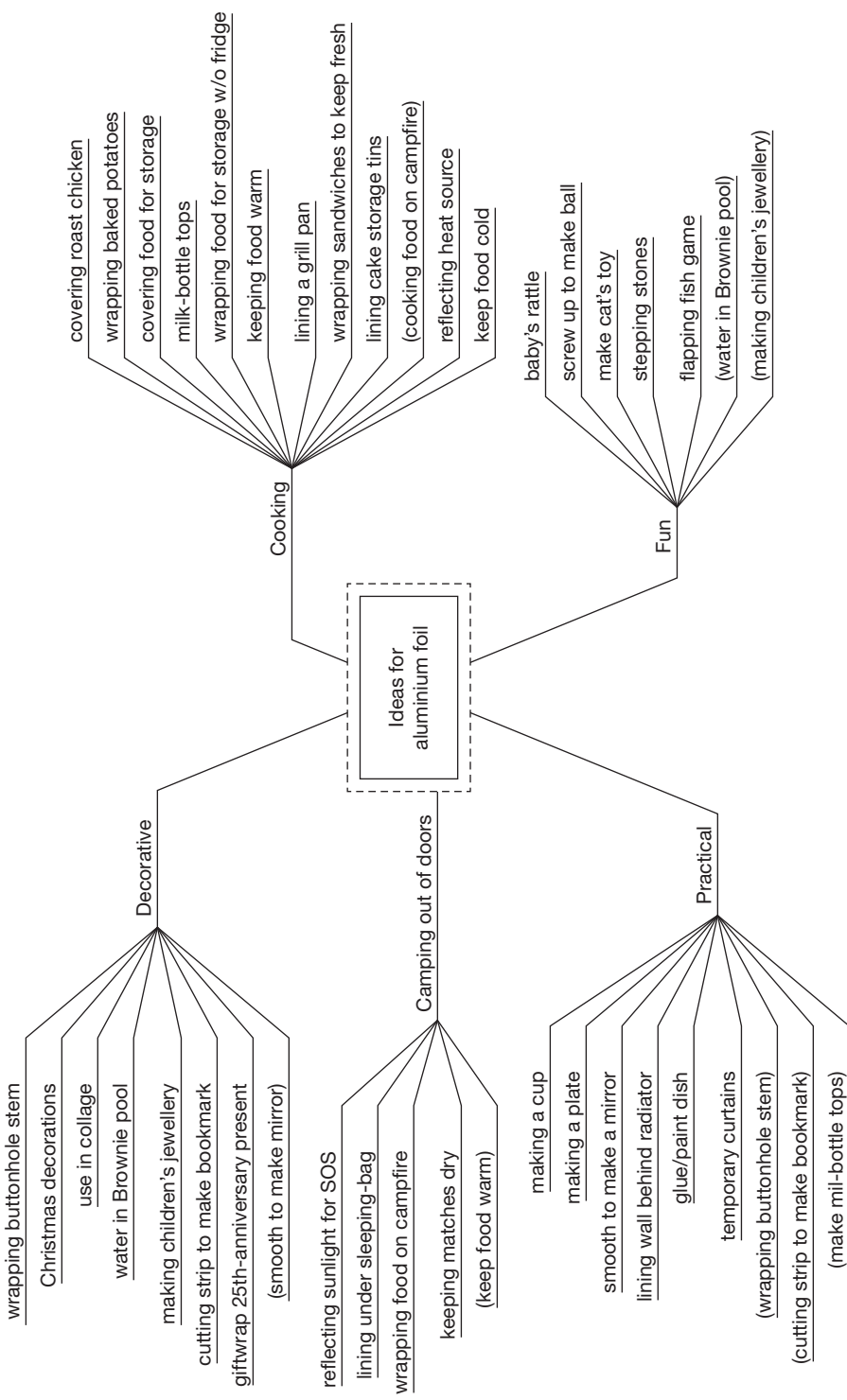


Figure 13.4
Mind map of ideas on the uses of aluminium foil

Table 13.1 An advantage–disadvantage table

	Options			
	Method A		Method B	
Criteria	Advantage	Disadvantage	Advantage	Disadvantage
Efficiency	x		x	
Cost		x	x	
Employee satisfaction	x		x	
Score	2	1	3	0

PMI: Plus/Minus/Interesting

PMI stands for ‘Plus/Minus/Interesting’. It is a development (by Edward de Bono) of the ‘pros and cons’ technique used for centuries.

One simply draws up a table headed ‘Plus’, ‘Minus’ and ‘Interesting’. In the column underneath the ‘Plus’ heading one writes down all the positive points of taking the action. Underneath the ‘Minus’ heading one writes down all the negative effects. In the ‘Interesting’ column one writes down the extended implications of taking the action, whether positive or negative.

Scoring the PMI table

One may be able to make an evaluation just from looking at the table. Alternatively, each of the points written down can be considered and assigned a positive or negative score. The scores assigned can be entirely subjective. Once done, the score is added up. A strongly positive score is a favourable evaluation while a strongly negative score suggests the idea is a poor one.

Example

Should I move from my house to a flat (see Table 13.2)?

Table 13.2 Plus, Minus, Interesting

Plus		Minus		Interesting	
More luxurious	(+5)	More expensive	(–6)	Easier to get to work?	(+1)
Close to city centre	(+5)	Less space	(–7)	Meet more people?	(+1)
		More noise	(–4)	Easier to get to places?	(+1)
		No garden terrace	(–5)		
Totals	10		–22		3

Overall total = –9: I’m happier living where I am!

Castle technique

The Castle technique is useful for evaluating a large number of ideas and is made up of four steps:

- 1 A time-limit for the exercise should be set – say, one hour.
- 2 Three criteria are used to evaluate each idea: *acceptability* (the extent to which it leads to a satisfactory solution), *practicality* (the extent to which it satisfies financial and time constraints) and *originality* (the extent to which it makes a significant improvement on the *status quo*).
- 3 Each participant in the evaluation exercise has the same number of votes as there are ideas. Participants are instructed to vote for each idea with either a ‘yes’ or a ‘no’ vote. One vote per idea per individual is allowed.
- 4 The two ideas that receive the highest number of positive votes (number of ‘yes’ votes minus number of ‘no’ votes) are then combined into one idea.

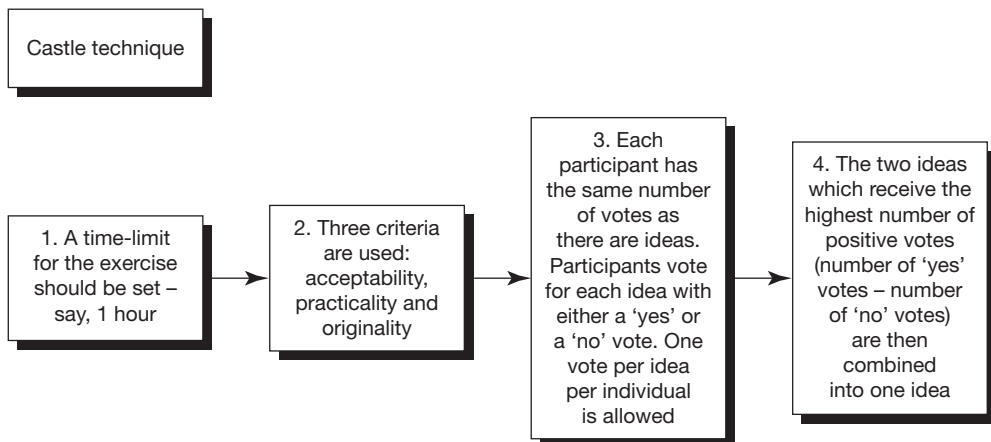


Figure 13.5

Castle technique

Sticking dots

This is a useful method for a small group of individuals to employ when trying to make an evaluation (see Geschka, 1979). Each group member has a fixed number of votes (usually these are physically represented in the form of self-adhesive coloured dots). Group members can then vote in any way they wish. The procedure is as follows:

- 1 Each member of the group has a card on which there are adhesive dots of a colour unique to that person. The number of dots corresponds to 10 per cent of the total number of ideas being considered.
- 2 Ideas are listed on cards or flip charts and pinned to a wallboard.

- 3 Ideas are evaluated by group members sticking dots next to the ideas they prefer. Dots can be allocated in any manner. An individual can place all his or her allocated dots against one idea if he or she so desires.
- 4 The ideas receiving the largest number of votes are selected for further analysis or implementation.

Note: If the number of ideas is less than 10, then the method of calculating the total number of dots available to a person needs to be modified. One suggestion is to divide the total by a suitable number which is less than the total number of ideas. Then add 1 to ensure that

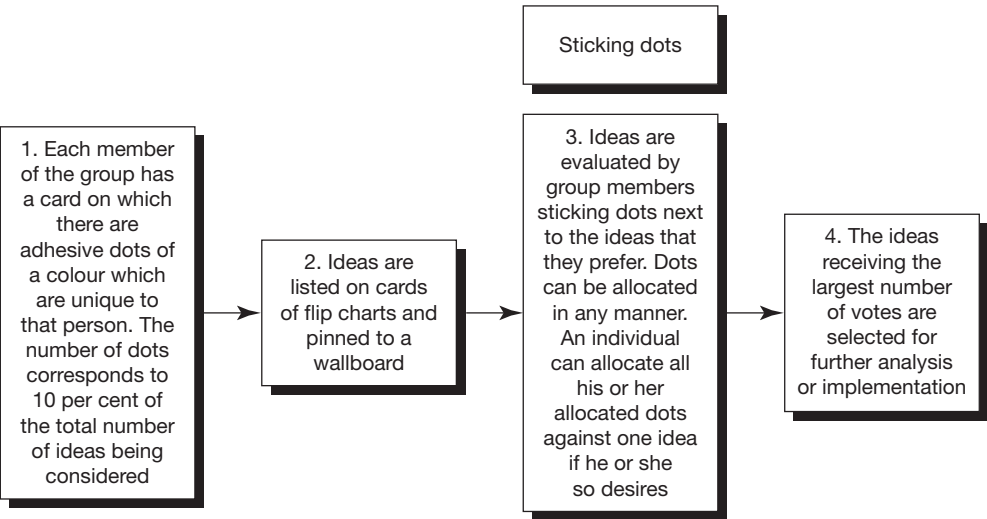


Figure 13.6
Sticking dots method

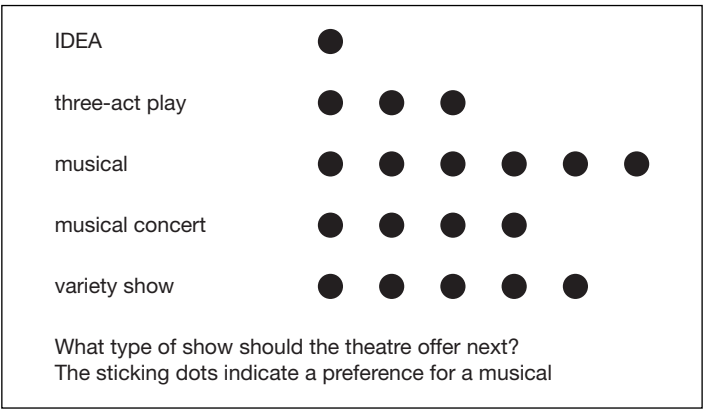


Figure 13.7
Example of using sticking dots

everyone has at least 1 vote – for example, if the total number of ideas is 5, then divide by 3, giving 1.6 votes and add an additional 1, giving 2.6 votes. Rounding this number up would 3 votes per person.

Creative evaluation

This also is a method which is useful for dealing with a large number of ideas. It attempts to present ideas in a format that will reduce the amount of time required for evaluation. All ideas are evaluated in terms of time and financial requirements (Moore, 1962). The procedure is as follows:

- 1 List the ideas.
- 2 Categorize the ideas into *simple*, *hard* and *difficult*. Note that simple ideas are those that can be put into action with a minimum of expenditure of time and money. Hard ideas require more expenditure, while difficult ideas require the most expenditure.

Like the advantages–disadvantages method, this approach is most suitable for a cursory examination of a large number of ideas.

Force-field analysis

This is a method used to get a whole view of all the forces for or against a plan so that a decision can be made which takes into account all interests. In effect, this is a specialized method of weighing pros and cons. Where a plan has been decided on, force-field analysis allows you to look at all the forces for or against the plan. It helps you to plan or reduce the impact of the opposing forces, and strengthen and reinforce the supporting forces. To carry out a force-field analysis, take the following steps:

- List all forces for change in one column, and all forces against change in another column.
- Assign a score to each force, from 1 (weak) to 5 (strong).
- Draw a diagram showing the forces for and against, and the size of the forces (see Figure 13.8).

Once you have carried out an analysis, you can decide on the viability of the project. Where you have decided to carry out a project, it can help you to analyse how you can push through a project that may be in difficulty. Here you have two choices:

- Reduce the strength of the forces opposing a project.
- Increase the forces pushing a project.

Often the most elegant solution is the first: just trying to force change through may cause its own problems (e.g. staff can be annoyed into active opposition to a plan instead of merely not welcoming it).

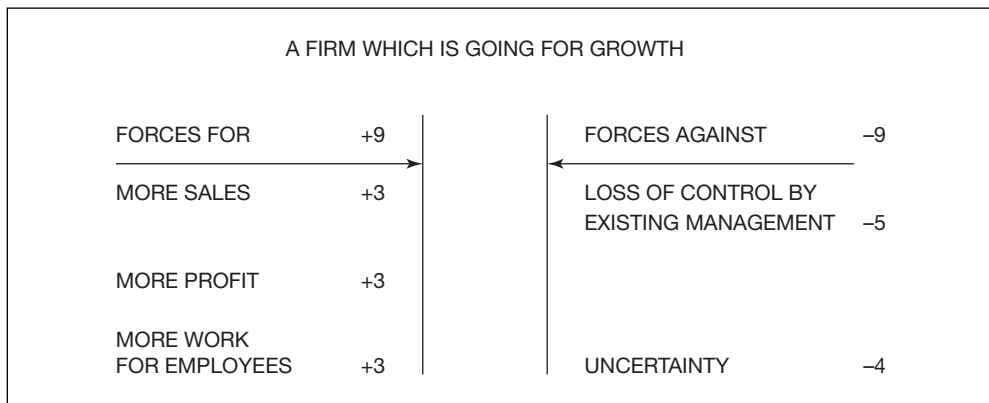


Figure 13.8

Force-field analysis

If you were faced with the task of pushing through the project in the example above, the analysis might suggest a number of points:

- By looking for a strategic alliance, loss of management control could be reduced (reduce loss of management control by 2).
- Coping with uncertainty is necessary for business survival (new force in favour, +2).
- More work will mean a more productive workforce (new force, +1).
- More sales will increase morale of sales force (new force, +1).
- More profit will increase satisfaction of shareholders (new force, +1).

These changes swing the balance from 9:9 (neither for nor against the plan) to 14:7 (in favour of the plan).

Force-field analysis is an effective method of getting a picture of all the forces for and against a plan. It helps you to weigh the importance of these factors and to assess whether a plan is worth pursuing. Where you have decided to proceed with a plan, carrying out a force-field analysis helps you identify changes that might be made to improve the plan.

Weighting systems

The first step is to generate evaluative criteria. Next, one assigns different weighting for each criterion, reflecting its importance with respect to the problem under consideration. Next, each idea is rated on the degree to which it satisfies each criterion. The lower the number, the less the criterion is satisfied. Finally, one multiplies the criteria-importance rating one has assigned to obtain the rated score. Weighted scores are then summed to obtain an overall weighted score for each idea or theme. An example of a weighted decision matrix is shown in Table 13.3, in which case weights and scores are out of a maximum of 5, where 5 is considered very important or high-scoring and 1 is relatively unimportant or low-scoring.

Table 13.3 *Weighted decision matrix*

Criteria	Criteria	Idea 1		Idea 2	
	importance	Score	Subtotal	Score	Subtotal
1 a	5	2	10	3	15
2 b	5	1	5	2	10
3 c	4	2	8	3	12
4 d	4	3	12	5	20
5 e	3	3	9	5	15
Totals			44		72

Generally, ideas with the highest overall scores are considered the best. However, one must take account of the fact that there may be some critical criteria that have to be satisfied, and even if an idea has the best score of those available it may still not be considered adoptable simply because it has failed to satisfy the requirements of particular criteria. In addition, one might specify that an idea must obtain a certain overall score before it can be considered adoptable. If the best idea available does not satisfy this criteria, it may not be adopted.

THE PROCESS OF CHOOSING

As can be seen from the foregoing, when exercising choice it is usual to have a set of alternatives and a set of evaluation criteria. Evaluating a list of alternatives involves measuring, trading off or scoring them in terms of the specified criteria and determining the relative importance of the criteria. This may involve several complexities:

- multiple criteria and multiple alternatives;
- a large number of criteria and sub-criteria;
- criteria which are not all equally important to the decision maker;
- some criteria may be qualitative while other criteria are quantitative.

Some of the typical suggestions for analysing such data involve:

- discussing the pros and cons of each alternative;
- analysing the costs and benefits, or weaknesses and strengths, of each alternative;
- ensuring the effective utilization of financial and other quantitative information in evaluating alternatives;
- sifting back through evidence provided in situation analysis to help reach a conclusion;
- assessing whether a chosen alternative solves a problem without creating new problems;
- justifying why an alternative has been selected *and* outlining why others may have been rejected.

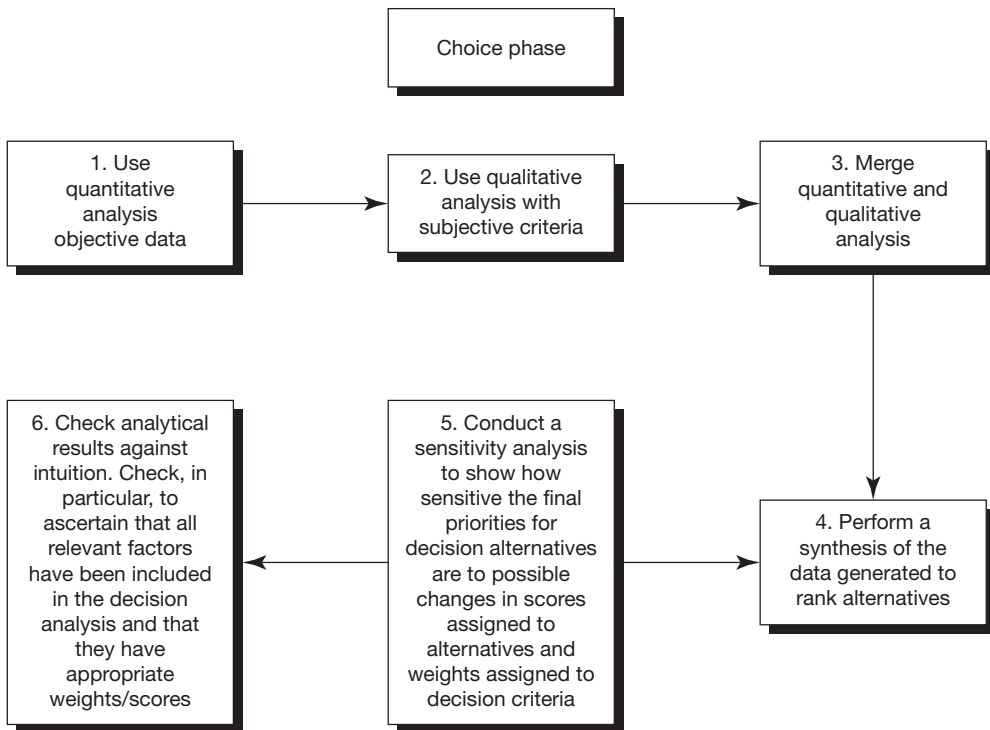
The general approach to adopt at the choice phase is as follows:

- 1 Use quantitative analysis on objective data:
 - (a) acquire data on the anticipated outcomes of each alternative with respect to each criterion;
 - (b) perform descriptive or experimental research to measure each alternative's performance on the criteria;
 - (c) consider whether quantitative tools such as simulation and optimization methods might be usefully applied; conduct a sensitivity analysis with the quantitative data.
- 2 Use qualitative analysis with subjective criteria:
 - (a) conduct a pro/con analysis;
 - (b) make use of expert judgement in dealing with the evaluation of alternatives with respect to the qualitative criteria.
- 3 Merge quantitative and qualitative analysis.
- 4 Perform a synthesis of the data generated to rank alternatives.
- 5 Conduct a sensitivity analysis to show how sensitive the final priorities for decision alternatives are to possible changes in scores assigned to alternatives and weights assigned to decision criteria.
- 6 Check analytical results against intuition. If they agree, you can be more assured that the decision is a good one. If they do not agree, find out why this is the case. Check, in particular, to ascertain that all relevant factors have been included in the decision analysis and that they have appropriate scores or weights.

The merging and evaluating of quantitative and qualitative data presents considerable choices. Moreover, synthesis and sensitivity analysis of such data presents a daunting task for all but relatively simple decisions. One sophisticated tool that can be used to get to grips with this process is the analytic hierarchy process (Saaty, 1980).

The analytic hierarchy process (AHP) enables the decision makers to set priorities and make choices on the basis of their objectives and knowledge and experience in a way that is consistent with their intuitive thought process. It has substantial theoretical and empirical support, overcomes problems associated with pro/con analysis, and the weights and scores technique by using a hierarchical structure of the decision problem, pair-wise relative comparison of the elements in the hierarchy and a series of redundant judgements. The approach reduces error and encourages consistency in judgements. The use of redundancy allows accurate priorities to be derived from qualitative judgements, even though the wording may not be very precise. This means that words can be used to compare qualitative factors and derive ratio scale priorities that can be combined with quantitative factors.

Expert Choice helps a decision maker examine and resolve problems involving multiple evaluation criteria. The software uses the AHP methodology to model a decision problem and evaluate the relative desirability of alternatives.

**Figure 13.9***The choice process*

QUALITATIVE EVALUATION: REVERSE BRAINSTORMING

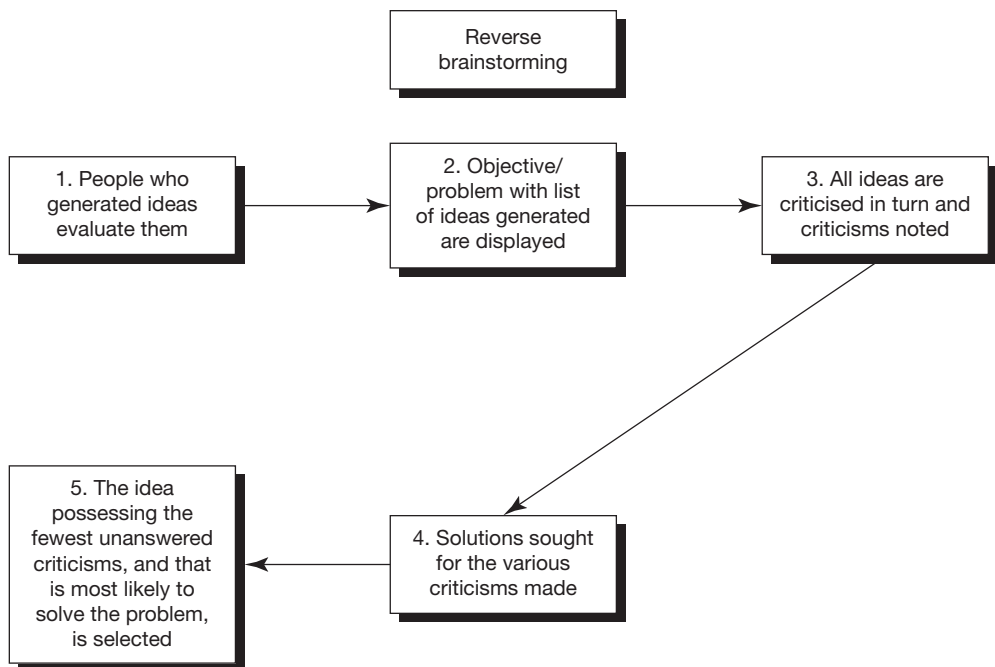
The technique was developed at the Hotpoint company (Whiting, 1958) as a group method for discussing all possible weaknesses of an idea, or what might go wrong with an idea when it is implemented. It is almost identical to classical brainstorming except that criticisms rather than ideas are generated.

Imagine the problem being how to counteract declining sales and that the following potential ideas for solutions were generated by classical brainstorming or some other ideation method:

- new advertising strategy
- offer discounts
- door-to-door sales
- change or improve packaging
- find new markets

The first step in reverse brainstorming is to suggest criticisms for the first of these ideas – new advertising strategy. Criticisms developed might be:

- too expensive
- unable to target the specific areas required

**Figure 13.10***Reverse brainstorming*

After exhausting criticisms for the first idea, the group begins criticizing the second idea, and the process continues until all the ideas have been criticized.

Using classical brainstorming the group then re-examines the ideas to generate possible solutions for each weakness that has been identified. For example, in the case of the second idea, 'offer discounts', the criticisms might be that people might perceive the quality of the product not to be good as a result of offering discounts. In the case of 'door-to-door sales', it might be the fact that unacceptable training and added costs will be incurred because of the need to employ more sales staff. Other criticisms will no doubt be found for the other ideas. As far as solutions to these criticisms are concerned, it may not be felt that there are any in, say, the case of a 'new advertising strategy'; however, in the case of 'door-to-door sales' it may be felt possible to employ part-time workers in order to lower the cost.

The idea that possesses the lowest number of weaknesses, and that will be most likely to solve the problem, is usually selected for implementation. Of course, one does also have to bear in mind the comparative seriousness of any unresolved criticisms.

Example

PROBLEM

Getting people to have a positive attitude towards adopting new ways of working.

IDEAS

- 1 Rewards associated with adopting new methods.
- 2 Firing those who do not cooperate and hiring new staff.
- 3 Training people and giving them the right kind of skills to do the new tasks.

CRITICISMS:

- 1 (a) May be too costly.
(b) May not believe they will receive rewards, or seen as further manipulation by management.
- 2 (a) Will cause even more hostility and resentment.
(b) Difficult to identify best method of recruitment – may still hire inappropriate people.
(c) Effort and time need to be spent on recruitment and interviews.
- 3 (a) Training requires additional time and cost.
(b) Not possible to provide training for every situation.

SOLUTIONS TO WEAKNESSES:

- 1 (a) Link the new methods with productivity increases.
(b) Provide written agreements to show commitment.
- 2 (a) No solution.
(b) Agree that all new appointees be on probation for a fixed period.
(c) Hire recruitment consultants.
- 3 (a) Provide training on the job.
(b) As (a), plus make sure first line managers can provide proper guidance and support to workers.

Although both ideas 1 and 3 seem to have resolved all the difficulties associated with them, 3 might well be the preferable alternative. This is because the problem at the core of the matter lies in a decrease in productivity which is incurred as each new method is adopted.

FINANCIAL EVALUATION

Projects may be cash generators (i.e. new products or services) or cash savers (e.g. new procedures aimed at reducing costs). Essentially, the way in which these projects may be evaluated in financial terms is similar. Money received today is worth more than the same amount of money we receive in the future. This principle reflects the fact that any money can be invested and earn interest for the period it is invested, so it must be more valuable than the same amount received at a later date. The discounted cash flow principle takes into account this principle.

There are several ways of using the discounted cash flow concept to evaluate capital expenditures. The most popular of these appears to be the net present value of an investment. Savings year by year are compared with the outflow of cash required by the investment. The expected savings received each year are discounted by selected interest rates. The outflow of

cash is also discounted by the same interest rate. If the present value of the savings exceeds the present value of the outlays after discounting at a common interest rate, then the project will be deemed fit for the purpose for which it was intended.

Example

A hospital is seeking to make savings of overall 10 per cent on all its administrative functions. One idea is to replace one of its manned reception points with an automated system. The cost of installing the system initially is £50,000 and each subsequent year it will be necessary to incur £5,000 maintaining the new system. Currently, the receptionist costs the hospital £20,000 a year. It is expected that further revisions will be made at the end of five years so the hospital wants to know whether the savings will meet the criteria set within the five-year period. Using the above example again and using a discount factor of 10 per cent as the minimum acceptable discount factor produces the following results.

Table 13.4 Example DCF calculation

Year	Discount factor (10%)	Investment (£000)	Savings	Cash flow (£000)	Present value £
0	1	-50	-50	-50,000	
1	0.909	-5	20	15	13,635
2	0.756	-5	20	15	11,340
3	0.631	-5	20	15	9,465
4	0.526	-5	20	15	7,890
5	0.438	-5	20	15	6,570
Total net present value					= -1,100

Using the net present value approach shows that the projects just failed to exceed the 10 per cent minimum rate of return set down by the organization. However, assuming that some projects will exceed the 10 per cent criterion, it is possible that the organization may be happy to include this project in the portfolio of savings strategies that it adopts.

The actual *yield* of the project can be determined experimentally with the aid of a spreadsheet by increasing the discount rate until the total net present value of the project equates to zero.

MATHEMATICAL EVALUATION

Mathematics can be used effectively to aid/evaluate possible solutions. In essence one is interested in assessing the potential pay-off of problem solutions. One way to achieve this is to consider the probabilities of certain pay-offs in the light of previous experience. Of course, this method can only be used where there is enough experience to calculate the odds with some degree of accuracy; and, of course, probabilities of this kind are of no use in a case where it has never been necessary to consider a similar instance before.

PAY-OFF TABLES

Alternative solutions to a problem can be laid out in a pay-off table (Table 13.5). Three probabilities are shown with respect to both costs and benefits associated with the ideas (.25, .50 and .25). Thus, for option A, for example, it is estimated that there is a 25 per cent chance the costs will be £2,500, a 50 per cent chance it will be £3,000 and a further 25 per cent chance that it will be £4,000. Benefits are calculated in a similar way.

Using the expected pay-off concept we can see that option A appears to have the best expected pay-off.

Table 13.5 Example of pay-off table

	Cost (£)			Expected cost (£) (EC)		Benefit (£)		Expected benefit (£) (EB)		Expected pay-off (£) (EB–EC)	
Probability	.25	.50	.25			.25	.50	.25			
Option A	2,500	3,000	4,000	3,125	5,200	6,000	7,600	6,200	9,000	3,075	
Option B	1,500	2,000	3,000	2,125	3,600	4,800	5,600	4,700	7,000	2,575	
Option C	2,000	2,500	3,000	2,500	4,200	5,700	6,000	5,400	6,000	2,900	

DECISION TREES

While pay-off tables are adequate for most purposes, decision trees enable one to see what effect a decision made at a particular moment will have on the options to be faced in the future. For example, suppose that a firm is operating at full capacity and demand for its products is rising. A 20 per cent rise in demand is expected, and this can be met by adopting one of two new methods of working (A and B). The net cash flow in the case of a 20 per cent rise in demand will be \$460,000 if new method A is used, or \$440,000 if the extra production is obtained by method B. However, there is a body of opinion in the firm that sales will not rise and that they will actually decline by 5 per cent, even though the rise is more likely. There is general agreement that there is a 60 per cent probability of a rise in sales of 20 per cent and a 40 per cent probability of a 5 per cent drop in sales.

If there were a 5 per cent sales drop, the cash flow would be \$340,000 if the company were to use method A and \$380,000 if it were to opt for method B. The alternatives are presented in the decision tree (Figure 13.10).

In order to take account of the probabilities, one has to make the following calculations:

$$\text{Method A: } \$460,000 \times 0.6 + \$340,000 \times 0.4 = \$412,000$$

$$\text{Method B: } \$440,000 \times 0.6 + \$380,000 \times 0.4 = \$416,000$$

Method B seems preferable. However, one does have to take account of future years' sales; and, assuming predictions can be made for a further couple of years, this would introduce

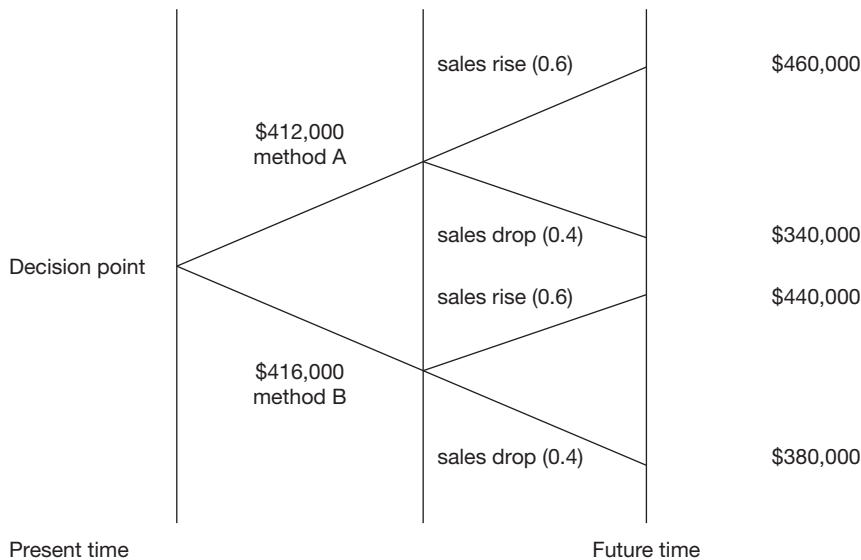


Figure 13.11
Decision tree

another two decision points and extend the branches of the decision tree. Care, however, has to be exercised in terms of extending a decision tree into the future as uncertainty increases the further ahead one looks.

EXERCISING CHOICE

Naturalistic decision making

Classical decision making (CDM) has its place in how we look at and evaluate options, and reflects two basic assumptions about decision evaluation. The first of these prescribes optimal choice from a fixed set of known options. As a result of this, prescribed choice models define optimality and explicit rules determine choice (Beach and Lipshitz, 1995; Orasanu and Connolly, 1995). The second of the assumptions describes the choices of an ideal hypothetical decision maker. As a challenge to these assumptions there is research that suggests that CDM is not an appropriate paradigm as far as 'real-world' decision making is concerned (Beach and Lipshitz, 1995; Klein, 1989, 1993, 1997). The research argues that situations within a CDM framework comprise simplistic, highly structured choice tasks that are in possession of complete information and that these have little relevance to 'real-world' choices (Duggan and Harris, 2001). Moreover, it is argued that in practice decision makers have insufficient time and resources during CDM operations to make truly rational choices.

Naturalistic Decision Making (NDM) is an alternative approach to the CDM approach. NDM theory evolved because of the deficiencies of CDM. In advocating NDM (Pruitt *et al.*, 1997) there is an attempt to more accurately describe the process involved in 'real world'. The archetypal NDM reflects choices or decisions entrenched in larger dynamic tasks made by

experienced decision makers. It acknowledges that decision making in the laboratory and in real life are not directly comparable (Beach and Lipshitz, 1995; Orasanu and Connolly, 1995). Klein (1989, 1993, 1997) acknowledges how experience informs decision making through the processes, of situation assessment, recognition and mental simulation in the *Recognition Primed Decision Model*. Indeed, It has been suggested that NDM can be thought of as ‘the study of how people use their experience to make decisions in field settings’ (Zsombok and Klein, 1997).

A primary difference between NDM and CDM is that people tend to find a solution that’s ‘good enough’ (satisficing rather than optimal). The chosen option will cannot be guaranteed to be the ‘best possible’ out of all the options, but will be good enough as a solution. A naturalistic approach to decision making and choice does not demand the exhaustive, simultaneous evaluation of multiple options as required by the CDM paradigm.

Strategic framing

Organizations are guided by strategic visions and planning processes. When they decide to innovate, they create strategic innovation frames to guide the innovation process. A primary obstacle is how to state innovation challenges and link together objectives so they will produce strategic results.

Many innovation initiatives may fail because all of the secondary objectives were not detailed and linked together appropriately. An organisation may simultaneously be concerned about maintaining its image, improving cash-flow, maintaining highly motivated managers, and, keeping good relations with other staff and trade unions. These may all be corporate objectives and the overarching task is how to linked them all together in the best manner. Complex, interrelated decisions such as these are associated with objectives that are nested within hierarchies of other, related objectives and multiple goals typically must be achieved to accomplish one primary goal (Richards, 1986).

The problem is to identify which objective or goal should be accomplished first to achieve the primary objective. It is also important to identify how the different objectives might be interdependent – i.e. linked in ways so that achieving one will help achieve another.

Visual diagrams of strategic goals and objectives can be represented in cognitive maps. For a comprehensive review of strategy, Van Gundy (2007) shows how the use of such diagrams and maps can help unravel the complexities of multiple goals and objectives when evaluating ideas. Here we will discuss a simplified illustration of the concepts involved. Let us assume that the four objectives that the organization is trying to satisfice are:

- maintaining its image
- improving cash-flow
- maintaining highly motivated managers
- keeping good relations with other staff and trade unions

If we arrange the objectives in the form of a hierarchical cognitive map (Figure 13.12), we will see that improving the cash flow is seen as the prime objective but that maintaining the organizational image is a contributing factor to this. Any idea that does not satisfice in terms of enabling maintenance of the organizational image may not contribute to improving the cash

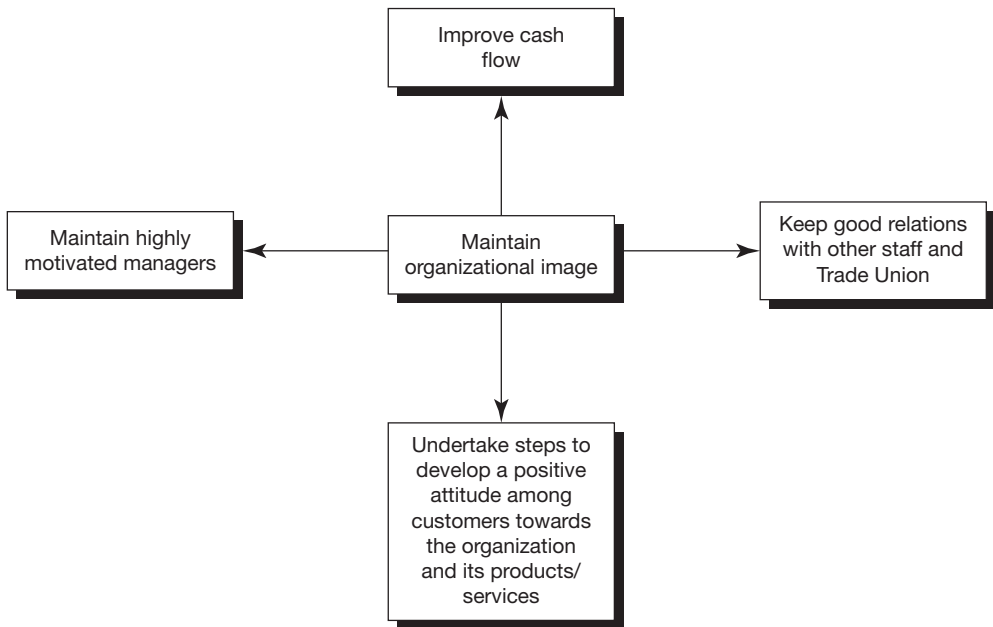


Figure 13.12

Cognitive mapping of the hierarchy of objectives and goals

flow. We say ‘may not’ rather than ‘will not’ because we cannot be absolutely certain of this. It could be that the firm can improve cash flow in the short term by issuing a notice of intention to customers that it will take legal redress where bills are not settled within forty days. This may be seen as the mark of an efficient company with whom it should continue to deal by some customers but may be viewed as overly threatening by others. The net effect may be productive in the short term but may be less effective or even have a negative effect in the long run. In addition to customer attitudes towards the organization, maintaining the organizational image is seen to be affected by motivation levels of managers and staff, too, so any idea should be seen to satisfy in this respect as well. A more elaborate cognitive map might take each of the boxes in the diagram and produce cognitive maps relating to each one. Ideas might then also be screened or evaluated against each of these to assess whether they are likely to satisfy on critical criteria.

QUESTIONS

- 1 Describe *two* different techniques that can be used to assist in the evaluation of ideas.
- 2 ‘Ideation techniques only generate insights into a problem and not solutions to a problem.’ To what extent would you agree or disagree with this statement? How does this influence how we might set about the process of evaluating the output of an ideation process?

- 3 A manager has a number of proposals for improving communications in the office. How might he or she set about evaluating the different proposals?
- 4 When might one use reverse brainstorming? Describe the process.
- 5 What are the advantages of using reverse brainstorming compared with other methods of evaluation? What are its limitations? Illustrate its application to a situation of your own choice.
- 6 What is the purpose of reverse brainstorming? Illustrate its use through an example of your own choice.
- 7 A canning company is considering vertical integration as a means of obviating supply- and distribution-chain problems that have become apparent in the past few months. Discuss how force-field analysis might be used to good effect in helping to analyse such a situation.
- 8 A company is considering three alternative ways of improving productivity. The expected costs, expected pay-offs and associated probabilities of events occurring are shown below. Using expected pay-off tables calculate the value of the best option.

<i>Option 1:</i>	expected costs	£450,000, probability	.35
	ditto	£290,000, probability	.25
	ditto	£300,000, probability	.40
	expected benefits	£750,000, probability	.40
	ditto	£490,000, probability	.35
	ditto	−£200,000, probability	.25
<i>Option 2:</i>	expected costs	£440,000, probability	.30
	ditto	£250,000, probability	.45
	ditto	£380,000, probability	.25
	expected benefits	£650,000, probability	.35
	ditto	£390,000, probability	.25
	ditto	£200,000, probability	.40
<i>Option 3:</i>	expected costs	£430,000, probability	.15
	ditto	£390,000, probability	.55
	ditto	£320,000, probability	.30
	expected benefits	£850,000, probability	.35
	ditto	£190,000, probability	.35
	ditto	−£250,000, probability	.30

- 9 Given the following information, construct a decision tree and assess the best course of action.

A firm is operating at full capacity and demand for its products is falling. A further decline is expected, and this can be met by adopting one of two new methods of working (A and B). The net cash flow in the case of a decline in demand will be £150,000 if new method A is used or £140,000 if new method B is adopted. However, there is a body of opinion in the firm that sales will not fall and that they will actually rise, even though the fall is more likely. There is general agreement that there is a

55 per cent probability of a fall in sales and a 45 per cent probability of a rise in sales. If sales rise, new method A would yield a net cash flow of £148,000 and new method B £142,000.

- 10 How might naturalistic decision making play a role in choosing which ideas or insights are worthy of further development?
 - 11 Organizations have multiple objectives and goals. Discuss how cognitive mapping might assist in evaluating new ideas or insights into a problem of your own choice.
-

CASES

Leaking yoghurt cartons

- JOHN: 15 per cent of yoghurt cartons in the supermarkets are leaking.
- BILL: Perhaps stronger cartons are required.
- JOHN: But that could increase the price of the yoghurts and make them too expensive.
- SALLY: Perhaps it may be possible to obtain cheaper material with which to have the cartons made up?
- LEN: I've heard there is a cheap source of cartons in Poland.
- SALLY: Could be import and supply problems there.
- JOHN: What about lower-grade materials for the cartons?
- LEN: They leak now – surely that would simply weaken the cartons and make them more likely to leak!
- SALLY: But it might be possible to redesign the cartons using the new materials so that they are actually stronger.
- JOHN: It is possible, but we would need to have that explored in some depth and get expert advice.
- BILL: What about new materials?
- SALLY: Perhaps we could ask the help of professional carton designers or some other experts?
- JOHN: Maybe.
- BILL: Could be that we should be looking at *when* the damage occurs.
- SALLY: I gather it is mainly during transportation.
- JOHN: Perhaps those handling the goods should receive some additional training.
- SALLY: Or better handling equipment at each end. It may be the handling equipment that is unsatisfactory.
- LEN: I gather no use is made of fork-lift trucks at all.
- BILL: Yes, but not all supermarkets have that sort of equipment.
- SALLY: Perhaps we should have some sort of publicity campaign to make everyone concerned with the handling of the product aware of the potential problems of rough handling?
- LEN: Punishments and rewards for careless and careful handling?
- JOHN: Does it really matter to the customer if some of the cartons leak?
- SALLY: Too many health hazards and scares associated with food products. We cannot afford risking adverse press!

-
- JOHN: I'm not sure. Shouldn't we perhaps investigate it?
- LEN: This transportation idea – maybe it's because of the distance the yoghurts have to travel before they reach the supermarket shelves. Perhaps if we could find some way of shortening the distance to be travelled.
- SALLY: Maybe we could deliver the yoghurt in bulk and pack it on the premises of the supermarket?
- BILL: Would the sales volume warrant it? Could we do that and maintain our profitability?
- SALLY: We could use supermarket staff and pay the supermarkets.
- JOHN: I don't know. It seems that it might be too expensive to do that.
- SALLY: We could supply in bulk to the large supermarket's group central distribution and warehousing points and have it packed there.
- BILL: It could still get damaged in transport.
- LEN: Perhaps we could supply the yoghurts in bottles?
- JOHN: There would be breakages and leakages, too.
- LEN: But perhaps nothing like as much.
- BILL: What about bulk delivery – either to individual supermarkets or to central distribution points, coupled with an emphasis on private brands?
- JOHN: Yes, I suppose we could explore that possibility.

Question

Assume that the above has been generated by on-line discussions between a team of people wanting to find a solution to the identified problem of leaking yoghurt containers. Use highlighting and reverse brainstorming to evaluate the ideas. Add ideas and criticisms of your own to facilitate the analysis and insights into the problem that can be generated.

The Go-Ahead garage

The proprietor of the Go-Ahead garage is looking for ways of improving its image with its customers, and through word-of-mouth communication is hoping to persuade more car owners to make use of its services. A brainstorming session came up with the following ideas:

- 1 Get rid of all excess grease and dirt on all cars serviced or repaired.
- 2 Ensure prices charged are very much in line with those of competitors.
- 3 Double-check all repairs involving tightening of screws.
- 4 Inform the customer of the exact nature of all guarantees regarding repairs.
- 5 Always consult customer before carrying out any repairs.
- 6 Make sure that the estimate corresponds well with the actual price charged.
- 7 Ensure cars are always ready for collection by a specified time arranged with the customer in advance.
- 8 Make sure that the mechanics are neat and tidy before they talk to customers.
- 9 Have a comfortable reception area for customers.
- 10 Ensure that staff understand the importance of being courteous to customers.
- 11 Provide a while-you-wait service for small jobs.

- 12 Offer do-it-yourself facilities.
- 13 Provide free advice regarding repairs or problems reported by customers.
- 14 Provide written estimates for all jobs.
- 15 Offer a 24-hour service.
- 16 Offer a free car-loan service while undertaking repairs or service.
- 17 Better petrol pump dispensers which do not damage car paintwork around the filler orifice or allow petrol to drip on to the bodywork.
- 18 Readily visible price list for standard servicing charges in the reception area.
- 19 Provide details of mechanics' experience and qualifications in a 'hall of fame' board in the reception area – and make sure that it is up to date.
- 20 Have an experienced member of staff inspect all repair jobs prior to vehicle release to customers and make sure that customers know who the inspector is.
- 21 Attract well-qualified staff.
- 22 Make sure all equipment and tools are regularly inspected and replaced at regular intervals.
- 23 Get AA and RAC approval.
- 24 Ensure adequate stocks are kept of common parts to avoid delays and reduce costs which are normally passed on to the customer.
- 25 Ensure the service management personnel who interact with the staff are well trained in customer interaction.
- 26 Better advertising.
- 27 Lower prices for regular customers.
- 28 More detailed reports for the customer of work carried out on the car.

Table 13.6 *Customer satisfaction rating of the garage*

<i>Satisfaction with:</i>	<i>Importance (mean value)</i>	<i>Garage rating (mean value)</i>
Reliability of repairs	10.0	7.3
Prices for repairs	6.5	6.5
Prices for service	5.3	7.2
Guarantees	7.5	5.5
Time taken for repairs	6.2	4.6
Time taken for service	5.4	3.9
Appearance of staff	3.2	6.5
Availability of spares	4.1	2.6
Help given to DIY	3.0	2.2
Helpfulness of staff	6.5	4.1
Opening hours	8.0	7.5
Forecourt petrol facilities	5.5	6.0
Staff expertise	9.0	4.2
Staff courteousness	7.1	3.5
Realism of estimates	8.0	3.1

Recently the garage had commissioned a market research survey to ascertain customer satisfaction with its services. The information shown in Table 13.6 had been ascertained using a ten-point scale:

Question

How would you suggest the garage sets about evaluating its ideas? Can you improve on the ideas suggested, evaluate all the ideas and make some positive recommendations?

Customer loyalty campaign

A petrol station is looking for ways of attracting customers and has come up with the notion of a customer loyalty scheme where free gifts are given to customers after they have collected a given number of tokens. Ideas suggested for free gifts include:

sweets	jigsaw puzzles	hammers
chewing gum	packs of playing cards	letter openers
adhesive tape	calculators	dusters
glue	silver pendants	potato peelers
model kits	music tapes	manicure sets
car shampoo	music CDs	aftershave lotion
maps	torches	hand-held TVs
key rings	writing pads	pocket radios
sachets of tea	sandwich boxes	cheap cameras
sachets of coffee	spanners	cheap quartz watches

Questions

- 1 Add to and expand the list of possibilities.
- 2 Use evaluation highlighting to sort ideas and gain more insights.
- 3 Use reverse brainstorming to pick out the best ideas.
- 4 How many tokens should be collected to redeem each of the items you finally suggest should be included in the loyalty scheme?

Hierarchy of objectives

SAM: We have to decide which of these ideas for magazine ads is most likely to produce the effect we want.

BILL: Yeah, yeah.

SAM: We have to get people to notice the ad that's the key point.

BILL: Yeah, yeah.

SAM: But to get them to notice it then there has to be something special about the ad.

BILL: Guess so.

SAM: So what makes an ad special, eh?

BILL: Attractive people?

- SAM: Well, partly. But there has to be something else.
- BILL: Customer benefits of the product?
- SAM: Tangible cues?
- BILL: Bright colours, perhaps, make it stand out in a crowd.
- SAM: Get people to read the ad?
- BILL: Yeah . . . but do we want lots of words in the ad or just a few and rely on the image to get people's interest?
- SAM: A picture tells a thousand words!
- BILL: Get people to construct their own narratives . . . their own story about what is going on in the ad.
- SAM: Complex isn't it? Depends on how our viewers are likely to react to the ads. Some may prefer one type while another may hate that type.
- BILL: OK, so what should we do?

Question

Suggest how Sam and Bill might set about tackling this problem. Is there a case for cognitive/strategic mapping here? Explain.

London Furniture Company

The firm is a furniture company situated in an area of London where the majority of the population is made up of adults aged between 21 and 40. The company manufactures and markets furniture to the local population. Some years ago the firm designed a new type of furniture that proved very successful, but recently its sales have taken an unprecedented tumble.

The initial statement of the problem now is:

- The firm wants to increase its furniture sales volume and is looking for ways of doing this.

Using the boundary examination technique the firm restructures the problem perception as follows:

- The firm highlights the words 'furniture' and 'looking'. In the case of the furniture it is felt that there are hidden assumptions about shape, size and style. In the case of the word 'looking' it is felt that a more proactive stance is in order and that one needs to create ways rather than just look for them.

This leads to a new problem redefinition:

- How can the firm improve the style of the furniture in order to stimulate people to buy it?

The next step is to generate some insights or possible solutions to the problem. The Gordon–Little variation of brainstorming is chosen for this purpose. In this case only the leader of the

1 Think of ways to improve something:

make it smaller

change its shape

make it interchangeable

use new technology

2 Think of ways to improve something in order to stimulate people:

make it easy to pick up

make it curvy

add some colours

use new material

give it a face lift

3 *Original problem:* How can the firm improve the style of the furniture in order to stimulate people to buy it?:

make it of stainless steel (from ‘polish it’)

use computers to design it (from ‘use new technology’)

design a chair which can also be used as a small table (from ‘make it interchangeable’)

paint it with an unusual type of varnish (from 'add some colours')

create a table lamp from wire (from ‘use new materials’)

While the firm feels it has generated some useful insights it decides that it would use the morphological analysis approach as well to see if this will produce further new ideas (Table 13.7).

Table 13.7 Morphological analysis matrix

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EVALUATION

The next step combined two or more sub-elements of the matrix to find useful ideas. The following are suggested:

- A circular, glass television with four screens capable of revolving for entertainment.
- A modern-style plastic chair with storage space under the scat and behind the back.
- A hexagonal stone TV cabinet.
- An oval metal imitation regency style kitchen table.

The next stage involves evaluating the ideas in terms of their time and money requirements. Ideas were categorized into three groups: simple, hard and difficult. Simple ideas are those that can be put into action with the minimum of expenditure of both time and money. Hard ideas require more expenditure of time and money, while difficult ideas require substantial expenditure of time and money. Using this method ideas are classified as shown in Table 13.8.

Table 13.8 *Evaluating the ideas*

<i>Simple</i>	<i>Hard</i>	<i>Difficult</i>
– Paint it with an unusual type of varnish	– Oval metal regency kitchen table	– Use computers to design furniture
– Design a chair that can be used as a small table as well	– Modern plastic chair with storage space	– Hexagonal stone TV cabinet
– Create a table lamp out of wire	– Circular glass TV with screen along edges	
– Make it of stainless steel		

This leads to further possible practical solutions:

- Design furniture out of cheap material (wire, glass, etc.).
- Design strange shapes and styles (hexagonal, triangular, etc.).
- Invest in computer technology

Question

Has the firm enough information to make a decision? If so, what should it do? If not, then why not?

FURTHER READING

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Implementing ideas

Introducing a new product

Getting a new product exactly right to meet the expectations of the market is fraught with difficulties. Early in 2001, the luxury-car manufacturer Jaguar (latter-day Ford in disguise) launched the X-type sports saloon, nicknamed 'Baby Jag', with lower prices than previous models, in an attempt to attract a younger, female audience. The company was banking on the arrival of the new X-type to send global sales past the 100,000 barrier. In the early 1990s it sold just 20,000 a year. While independent market analysts predicted that the Jaguar X-type would be a success, they thought that it would not displace the current market leaders in this sector of the car market. It was felt that sales would be held back by Jaguar's failure to foresee Europe's preference for diesel power (given the high cost of fuel in many European markets). The X-type was introduced with just two petrol engines – 2.5 and 3.0 litre V6s. Somewhat belatedly, in mid-2003 a 2-litre diesel X-type was introduced to the market.

The implementation of any new idea in the commercial world, whether it is a new product or a new administrative process, may be likened to the situation facing Ford when it launched the 'Baby Jag'. Time, money and effort are put into getting a new project off the ground, and it has to be marketed to those who the project will most affect – whether they are customers, employees or stakeholders of some other kind. Getting people committed to a new venture must take account of their willingness and ability to participate in getting such ventures off the ground. The marketing of new ideas has to be undertaken in a systematic manner and attention paid to detail in the implementation of such ideas. In this chapter we shall review the factors that have to be taken into account in such circumstances and offer suggestions as to how this might be best achieved.

INTRODUCTION

In this chapter we examine some of the problems of implementing ideas. First we consider the various sources of resistance to change. Next we look at the role of communication in overcoming resistance to change. This is followed by an examination of how ideas might be

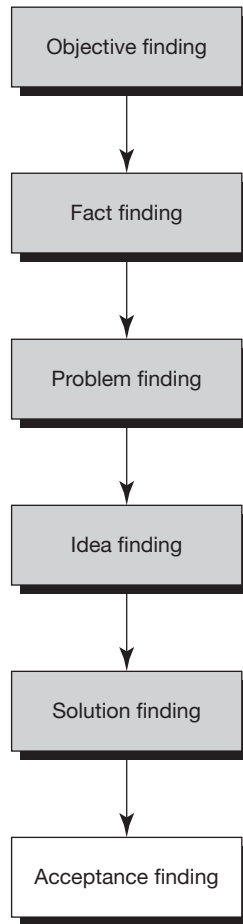


Figure 14.1

Position of the chapter within the CPS process

put into action. Lastly we look at how we might foster a climate for change in an organization.

The successful introduction of new ideas helps maintain an effective organization and sustain a competitive advantage in the marketplace. New ideas are not accepted automatically; they are often resisted. Knowing what resistance there will be is the first step in introducing change. Getting people to accept the need for new ideas through good communication is a key element in the process of effecting change. Various communication models are considered, along with identifying within an organization spheres of influence needed to implement ideas and change. The chapter considers how various computer application packages such as *COPE/Decision Explorer*, *PERT* and computer simulation can help the implementation and acceptance of new ideas. Contingency plans are necessary when implementing ideas. One needs to anticipate the problems that will arise and the objections that will be raised. The importance of ‘potential problem analysis’ as a technique that can be used to good effect in this latter context is considered in the chapter.

IDEAS ARE NOT READILY IMPLEMENTED

THE PROBLEMS OF INTRODUCING NEW IDEAS

In *The Prince*, Machiavelli wrote: 'there is nothing more difficult to take in hand, more powerless to conduct or more uncertain in its success than to take the lead in the introduction of a new order of things because the innovators have for enemies all those who would have done well under the old conditions and lukewarm defenders in those who may do well' (Ch. 5).

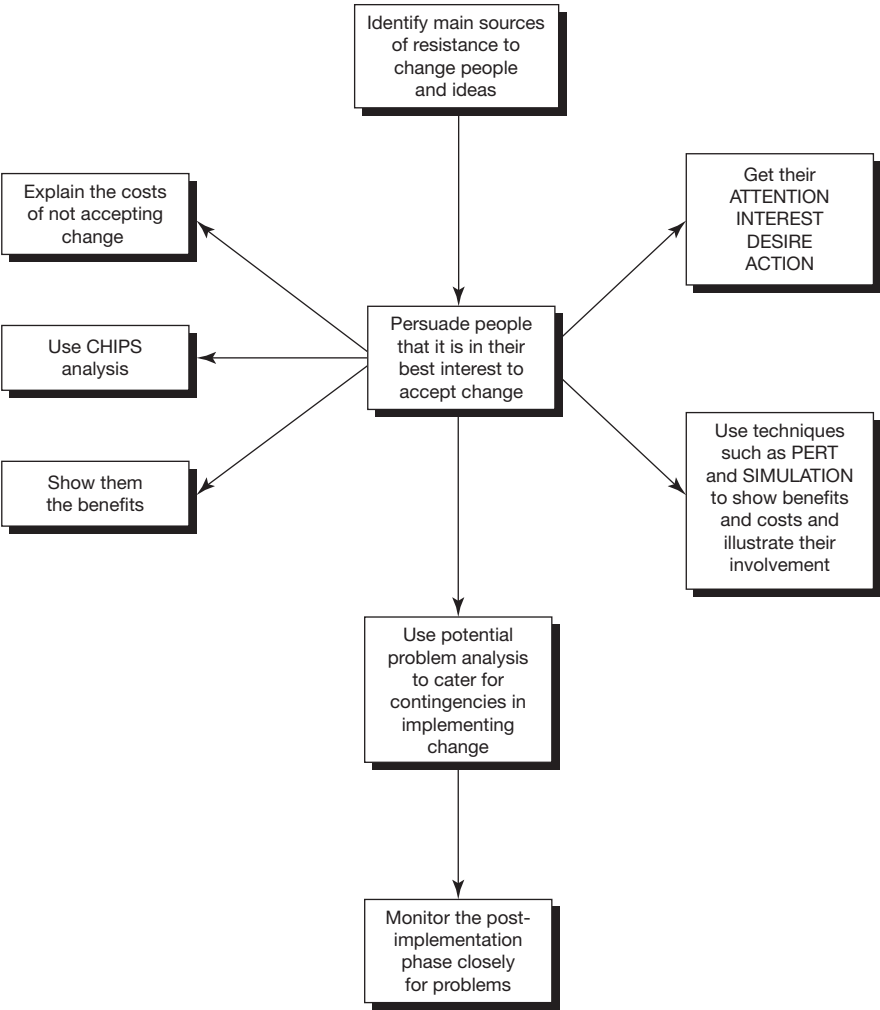


Figure 14.2
Overview of acceptance finding

Getting new ideas off the ground can meet considerable opposition, and it is important to recognize this before embarking on introducing change into an organization. Some insights into the reasons for this can be obtained by looking back, even before the time of Machiavelli.

We may wonder why the ancient Greeks, who produced so many great philosophers, artists and writers, did so little in the sphere of applied science. The reasons were both sociological and psychological. It was generally accepted in those times that the normal condition of a large part of mankind was that they must toil for the few. A shortage of labour or energy was never a problem. When a job had to be done the slaves had to do it, and they were whipped until it was done (Larsen, 1961).

It is easy to imagine that throughout history the ideas of original inventors were sufficient to start off some new development. However, it is obvious on deeper reflection that the inventions themselves, as well as those who produced them, would be bound to fail if there was no need, demand or social basis for the ideas. As a consequence it is not surprising that many so-called inventions have been produced several times until eventually the time for their introduction has been appropriate. At the same time, developments in people's ways of life, new social orders influencing production and demand, have stimulated inventors to work along certain lines. It may not therefore have been pure chance that the railway and steam engine reached maturity at about the same time, and that they were brought together for the first time in England, the country, at the time, where social and economic developments were more rapid than anywhere else in the world. 'The locomotive is not the invention of one man,' said Robert Stephenson, 'but of a nation of mechanical engineers' (Larsen, 1961: 125).

SOURCES OF RESISTANCE TO CHANGE

There are many sources of resistance to change. Perhaps the most significant is that many people are afraid of new ideas. They may feel threatened by new ideas and fear that they will not be able to cope with a change in working patterns that is demanded of them or that they will not understand how to use a new technology. Even today there are many older people who are afraid of the desktop computer. Another point is that people may have a vested interest in not accepting change. Why change when you are doing very nicely with things as they are?

Resistance to change has many sources (see, for example, Lawrence and Greiner, 1970). Fear of the unknown, lack of information, threats to status, fear of failure and lack of perceived benefits are examples of such sources. However, one of the most important sources is that people resist being treated as pawns in an organizational reshuffle. People like to feel that they are in control of what is happening to them, and the more that change is imposed from outside by others the more they will see it as something to feel threatened about and the more they will resist it. People resort to using their last remaining powerbase: their will to cooperate.

People like to feel that they are in control of what is happening to them, and the more that change is imposed from outside by others the more they will see it as something to feel threatened about and the more they will resist it.

Human and technological factors produce implementation blocks. While some of the blocks are intentional and are designed as checks to ensure that an organization always functions smoothly, other blocks are unintentional and may arise from how the organisation has developed historically – organizations tend to stagnate as they age. A third type of block may arise from

an outside source – a change in market demand, for example, can act as a barrier to idea implementation.

Blocks to implementing ideas and change reflect such things as a lack of adequate resources to implement ideas, a lack of commitment and motivation in those required to implement ideas, resistance to change, procedural obstacles, perceived risk associated with implementing ideas, political undercurrents, lack of cooperation in the organization, and so on. The important thing is to uncover what resistance is likely to arise and what the reasons for the resistance are likely to be. With this information one can look for ways of implementing ideas so that the resistance encountered can be reduced.

ROLE OF COMMUNICATION IN OVERCOMING RESISTANCE TO CHANGE

The key to effecting change is to involve people in the process early, to consult them and to get them to take ownership for themselves of the new ideas that are to be introduced (see, for example, Coch and French, 1948). To sustain a programme of change it is essential to understand the culture of the organization in which new ideas are to be introduced. New ideas that run counter to the traditional values of an organization are the ones that are most difficult to introduce. Organizational culture is the pattern of shared values and norms that distinguishes it from all others (Higgins, 1994; Kotter, 1997). Before one thinks about implementing change one needs to create a readiness for change within an organization. One needs to think of the organization as an internal market for change initiatives where ideas have to be marketed. This means that opinions and attitudes have to be assessed and potential sources of resistance identified. Commitment to change can be instigated by helping people to develop a shared diagnosis of what is wrong in an organization and what can and must be improved (see Kotter, 1997).

Communication is the spearhead of ensuring that successful change can take place (see, for example, Higgins, 1994). It helps to overcome ambiguity and uncertainty, and provides information and power to those who are the subject of change. It enables them to have control over their destiny, to understand why change is necessary, and provides the suppressant to fear. Through open communication channels, people can express their doubts about the effectiveness of proposed changes and can understand the necessity for new ideas. Relying on an attempt to implement ideas only from the top is likely to meet with difficulties. Grass-roots change is the only way to ensure that process becomes firmly embedded. It is natural for people to resist change, and by anticipating, identifying and welcoming resistance we convert resistance into a perceived need for change.

'Innovation – any new idea – by definition will not be accepted at first. It takes repeated attempts, endless demonstrations, monotonous rehearsals before innovation can be accepted and internalized by an organization. This requires courageous patience.' (Warren Bennis). Available at: www.leadershipnow.com/creativityquotes.html (accessed: 28 March 2013).

PUTTING IDEAS INTO PRACTICE

There are a variety of tools and techniques that can be used to good advantage in helping to introduce new ideas in a systematic and planned way into an organization. 'Consensus mapping', recommended by Hart *et al.* (1985), is one such tool. It helps those involved in the process of implementation to visualize, analyse and organize ideas that are sequence dependent. In applying the technique, a graphic map is produced that portrays implementation steps and ideas in relationship to one another and shows how they are related to one another. *COPE* or *The Decision Explorer* is a computer package that can be used to achieve a similar goal (see pp. 287 and 294). *PERT* networks and research-planning diagrams may also be used to good effect in facilitating the implementation of new ideas. Similarly, computer simulation methods can provide a basis for showing the impact new ideas will have on people and processes as well as on costs and efficiency. Another useful method, put forward by Kepner and Tregoe (1976), is 'potential problem analysis'. This method places an emphasis on a systematic approach to anticipating problems that are likely to stand in the way of the successful implementation of a project, changes or ideas. Some of these methods are discussed in this chapter.

Besides the use of tools to systematize the introduction of new ideas, there is also the task of persuading people who are going to make use of those ideas that are worth using. Ideas may have to be sold to people who can authorize their implementation. This may make it easier to arouse subsequent motivation to implement ideas among those who have to do the job and make the chance of a successful implementation more likely. Putting ideas into practice usually requires:

- 1 an ability to get people to accept ideas;
- 2 an ability to cope with difficult obstacles;
- 3 an ability to plan and manage time in an effective manner;
- 4 an ability to create the enthusiasm and motivation to follow through ideas.

Persuading people to view new ideas in a favourable light when they are not readily disposed to do so essentially involves influencing and changing attitudes. To do this it is first necessary to convince people that they need to be dissatisfied with the status quo. It is important to note that people may not readily recognize that they are dissatisfied with the current situation. One cannot assume that people will readily accept that a problem exists, even when it is blatantly obvious to an outsider. It may be necessary to:

- 1 Create an awareness of problems that exist and make people recognize that there is a need for change and a need to adopt the idea that is being put forward.
- 2 Point out to people the potential hazards and pitfalls of not accepting the need for change.
- 3 Stress the benefits of change to the individuals involved since they will only be motivated to accept and to adopt new ideas when they perceive and acknowledge that it is in their own best interest to do so.

Spheres of influence

We have to recognize that people are part of a group in the organization. Getting people to change means getting the group to change and involves understanding the nature of group dynamics. Identifying opinion leaders, action initiators, people with status and influence in the group, and those most affected in carrying out the changes required is therefore very important. It is also important to have the backing of someone who has the authority and the resources to enable an idea to get off the ground. Knowing how to communicate with the target audiences is therefore an important skill when trying to implement new ideas and effect change.

Communication models

Communication theories offer several different descriptive models of the process by which it is thought that people adopt ideas as a result of receiving information about them. The models can also be used prescriptively as aids to producing communications that are intended to bring about action. One of the earliest models used was the AIDA model (origin uncertain). The model comprised four stages:

- attracting ATTENTION
- maintaining INTEREST
- arousing DESIRE
- getting ACTION

The early 1960s saw considerable interest in advertising models. Lavidge and Steiner (1961) developed the 'hierarchy of effects' model. This model was directly related to understanding how marketing communications worked. The model implied a six-stage process where the customer moves through stages from awareness to purchase:

AWARENESS → KNOWLEDGE → LIKING → PREFERENCE →
CONVICTION → PURCHASE

Different persuasive activities were considered fitting to move customers through the various stages. To develop AWARENESS teaser campaigns, sky writing, jingles, slogans and classified advertisements are considered suitable. In order to convey KNOWLEDGE, announcements and descriptive copy were recommended. Image advertising and status or glamour appeals are envisaged to be ways of producing a LIKING, while competitive advertisements and argumentative copy are more relevant to generating a PREFERENCE. Finally, price appeals and testimonials may produce CONVICTION, while deals, last-chance offers and point-of-purchase retail-store advertisements are seen as ways of encouraging actual PURCHASE.

Contemporary with Lavidge and Steiner, Colley (1961) produced a model called DAGMAR, which stands for defining advertising goals, measuring advertising results. It was argued that a communication must carry a prospect through four levels of understanding:

AWARENESS → COMPREHENSION → CONVICTION → ACTION

Shortly after, Rogers (1962) suggested the 'Innovation Adoption' model. In this case the theory was not directed specifically at the relationship between marketing communications and sales but rather at the adoption of a new idea. Several stages were suggested in the model:

AWARENESS → INTEREST → EVALUATION → TRIAL → ADOPTION

All of these models seem to fit in well with the more general communications model of:

EXPOSURE → RECEPTION → COGNITIVE RESPONSE → ATTITUDE
→ INTENTION → BEHAVIOUR

The point about all the above models is that attitude change and subsequent action are seen as a gradual step-by-step process. The models will be appropriate for different circumstances depending on exactly what is required concerning the idea that is being implemented. Moreover, different ways of communicating, and even different communication media, may be more appropriate for moving people from one stage to the next.

Effective communications need to appeal to the needs and wants of the recipients. They should give the recipient a motive or incentive to act. They also need to generate involvement with the message on the part of the recipient by asking questions that leave the message incomplete. In addition, they should also explain exactly what course of action it is expected the recipient will follow.

Getting people to consider adopting an idea or changing behaviour can be achieved through appealing to their cognitive processes (see Burnett, 1993). One needs to arouse desire, indicate a need, or offer a logical reason why they should cooperate. In so doing the message becomes implanted in the recipient's memory and can be triggered by future needs, motives and associations. However, one does have to remember that the rational approach may not be so effective for some recipients or in situations where there is likely to be less involvement in the action required. In these cases emotional appeals may be used. The appeal, theme, idea or unique selling proposition is what the communicator has to get over to the target audience to produce the desired response. Benefit, identification, motivation are all concepts that can be built into the message. Messages can be built around rational, emotional or moral appeals, themes, ideas or unique selling propositions. Economy, value and performance are used in messages with a rational content. Emotional appeals make use of both positive and negative aspects. On the negative side, this involves fear, guilt and shame (Janis and Feshback, 1953), while on the positive side it comprises humour (Beggs, 1989), love, pride and joy. Too much fear in a message may cause the audience to reject it. The use of humour may generate 'noise' and interfere with the message. Moral appeals address to people's sense of what is right and just.

REDUCING RESISTANCE TO CHANGE

Getting people to change their attitudes is fundamental to reducing resistance to new ideas. While creating dissatisfaction with the status quo is one method of effecting attitude change and getting ideas implemented, there are other ways of achieving the same objective. A good way to counter resistance to change is to pre-empt the possibility of it occurring. As mentioned

above, getting people involved in the idea-development process in the first place anticipates resistance to change. Resistance is reduced because people feel that they have had the opportunity to participate and express their view.

In the same way that attitude change is seen as a gradual process, the implementation process should follow a similar pattern. New ideas that involve substantial change need to be implemented gradually, smoothly and systematically. Resistance to change can be softened by making the changes tentative rather than definite or permanent. It is a good strategy to get people to try out ideas initially for a short period. In addition people should be encouraged to say whether they think an idea is working. If a new idea fails, it does not cause its originator as much loss of face under such circumstances.

Encouraging people to recognize that change is a normal facet of life is important. If they come to accept this viewpoint, they will not see change as being out of the ordinary when it is applied to them. It can help them to become less emotionally attached to the status quo.

In introducing a new idea one has to be reasonably sure that it is worthwhile. There is a cost associated with change, for it causes disruption to those who are concerned. However, provided that the required change is accompanied by demonstrable benefits that more than offset the costs of disruption, the new idea is more likely to meet with little resistance. In addition, it will pave the way for the introduction of future new ideas in that it is more likely to be seen as being in the interests of the organization.

Cognitive mapping devices

Cognitive mapping is a modelling technique that portrays ideas, beliefs, values and attitudes and their relationship to one another in a manner that facilitates examination and analysis. Such data are collected through focus-group interviews or in-depth personal interviews. Cognitive mapping is a practical development of the implications of Personal Construct Theory, which in turn purports to reflect how people construe their world (Kelly, 1955). A cognitive map is a network of ideas and is illustrated as nodes linked by arrows, representing goals and actions. SODA (Strategic Option Development Analysis) is such a methodology and uses a computer model called *COPE* (now known as *The Decision Explorer*) to help in the analysis. A facilitator interviews individuals involved with a problem and draws up their cognitive maps of the factors relating to and influencing the situation subsumed in the problem. A single person might suggest tens of factors relating to a particular problem. The facilitator constructs a *COPE* model to reflect a person's view. The group as a whole can express thousands of views, and *COPE* is designed to accumulate and compress this diversity of ideas.

COPE has been deployed to help identify resistance in implementing ideas (see Bessant and Buckingham, 1989). By showing groups their own and others' perspectives on an issue it is often possible to ease problems encountered in implementation.

COPE is primarily designed to produce such cognitive maps, and recent versions facilitate this through a graphic user interface. Since it also has the facility to trace paths throughout the very complex network structures that can be constructed, it can also help to establish cause–effect relationships and hence build causal models. Simpler devices such as mind maps and research-planning diagrams can also be used to good effect. While they lack the sophistication of such programs as *The Decision Explorer (COPE)*, they do enable one to record graphically the

Action required to help ensure that implementation stands the best chance of success

- Make it a stimulating experience for those involved or affected by the changes involved.
- Publicize the changes involved and try to ensure encouraging media coverage at all times.
- Ensure the objectives of the change are congruent with the organization's aims and objectives
- Find a reliable task-oriented project manager to ensure that the programme of change is properly implemented in the planned manner and according to the planned schedule.
- Identify all relevant stakeholders influenced by the planned changes and ensure they are kept informed or otherwise involved throughout the change programme.
- Pay attention to ensuring effective communication with all programme participants.
- Ensure senior or top management backs the planned changes involved and will support action taken to implement all the changes.
- Ensure that the purpose and projected outcomes of the changes are clearly stated and understood by all concerned.
- Build in mechanisms and develop an organizational climate where it will be possible to tolerate mistakes being made by people during the implementation of the changes.
- Create a small implementation team who hold the decision-making power.
- Consider the broader strategic issues and the implication of the changes for these when considering the changes that will be required.
- Identify a person or persons who feel ownership of the planned programme of changes.
- Persist in the face of resistance and show determination but take cognizance of all objections and ensure that these are given serious consideration.
- Document the planned changes and the progress made in the process of implantation.
- Produce adequate control and contingency measures and mechanisms.
- Put in place support governance structures and ensure that agreements are recorded and verified.
- Obtain regular feedback from all engaged in or who have an interest in the changes as they are planned and made.
- Demonstrate early ongoing success.
- Ensure that the implementation is put into operation speedily to avoid losing focus and momentum.
- Pay attention to and learn from errors as they occur and act on the information obtained immediately.
- Study what other innovators have encountered when designing and implementing changes.
- Make sure all necessary resources are available at the right time and in the right place.

relationship between events and people's attitudes as they impinge on the implementation of new ideas. Such tools facilitate consensus mapping, and their visual impact can be helpful when trying to get the cooperation of those who are needed to ensure the success of a project.

PERT

Planning, scheduling and control in the introduction of new ideas and the implementation of organizational changes can be greatly enhanced with the aid of *PERT* (project evaluation and review technique). The tool helps to monitor and organize resources to enable a project to be completed on time and within budget limits. It is customary to model projects and planning activities as networks to capture the nature of the interrelationships and sequencing of their various component parts.

PERT/CPM is basically a three-part technique:

- 1 *Planning*. This incorporates an in-depth analysis of the project or planning task and construction of the network to describe it.
- 2 *Scheduling*. This involves the analysis of the project or exercise to determine completion time, critical activities, and start and finish times for each activity.
- 3 *Controlling*. This includes using the network and schedule to keep track of progress and to make any revisions necessary to keep the project on schedule and within budget.

Seeing a whole project in perspective helps those involved to understand what is happening or about to happen and can help to dispel people's uncertainties. *PERT* provides a framework and timescale within which new ideas are to be implemented.

PERT/CPM is a sophisticated tool for use in planning but a more simple but useful approach is to use a Gantt chart. In the example shown in Figure 14.3, a firm is implanting changes to its organizational procedures. The Gantt chart shown outlines the timescale for undertaking various activities.

Computer simulation

Computer simulation models enable one to study how a system reacts to conditions that are not readily or safely put into practice in a real situation. With the aid of a computer simulation model the user can study how the behaviour of an entire system can be altered by changing individual parts of the system. A computer simulation model is usually defined in mathematical terms within a computer program. The functional relationships among elements within a system are represented by mathematical equations, and when the program is executed the mathematical dynamics become analogous to the dynamics of the real system.

Computer simulation brings life to planned changes and helps people to appreciate what will be the result of making such changes. The dynamic and visual nature of this way of showing the effect of change actually can help people to visualize for themselves the effect of accepting new ideas and change.

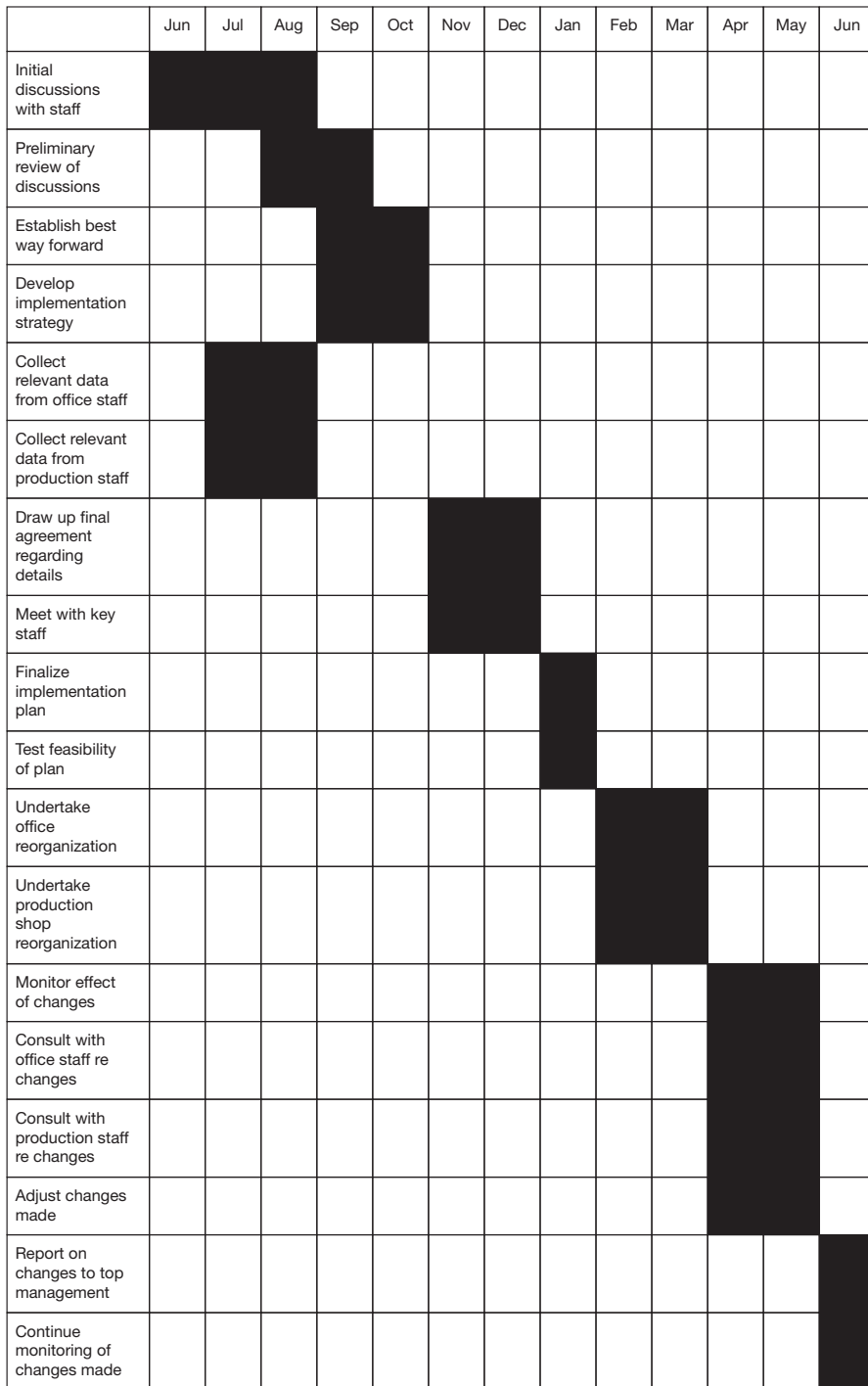


Figure 14.3

Gantt chart detailing project timescales

Potential problem analysis

Kepner and Tregoe (1976) developed potential problem analysis (PPA) to alleviate the risk of new problems occurring during the implementation of new ideas and processes. Eight steps were involved in PPA:

- 1 Determine exactly what should take place if the task is to be done successfully.
- 2 Employ *reverse brainstorming* to identify everything that can go wrong during implementation.
- 3 Detail highlighted problems.
- 4 Assess and evaluate the impact of each identified potential problem on the implementation of the whole project.
- 5 Look for causes of the identified new problems.
- 6 Assess the probability of occurrence of each one of the potential problems.
- 7 Determine ways of minimizing the effect of the potential problems.
- 8 Develop contingency plans for the most serious potential problems.

PPA provides a systematic framework to help implementers of ideas avoid the occurrence of the events of Murphy's Law (Bloch, 1990). Murphy's Law states that if anything can go wrong it will. PPA also helps to get to grips with many of the possible corollaries to Murphy's Law. For example:

- 1 Nothing is as easy as it looks.
- 2 Everything takes longer than you think.
- 3 If there is a possibility of several things going wrong, the one that will cause the most damage will be the one to go wrong.
- 4 Left to themselves, things tend to go from bad to worse.
- 5 Whenever you set out to do something, something else must be done first.
- 6 Every solution breeds new problems.

Post-implementation

One has to make sure that what has been implemented actually works for more than just a couple of days and does not fall down because of something that has not been foreseen. That is not to say there will not be complaints about what has been implemented. It is quite likely that the change agents or idea implementers will be inundated with messages, both from people who supported the new idea and from people who opposed it, saying that things do not seem to be working properly.

Feedback messages about new ideas that have been implemented may take the form of:

- (a) *Grousing*. This usually does not require action and simply reflects people's resistance to change. People may complain because they are required to do things in a different way.
- (b) *Errors of detail*. Aspects of detail may have been overlooked. When the detail is not critical it is usually possible to remedy the situation fairly easily. Elements that are critical to the functioning of the whole, however, are more problematic and may require thorough

analysis and reflection. In some cases they may even temporarily hold up matters until they can be resolved.

- (c) *Apparently major errors.* These can be either real or supposed. In the latter case it is simply a matter of reassuring all concerned that it is only supposition. Where the problem is real, then the implementation of the whole project may be at risk.

Ideas and changes must be workable and reliable. Thinking through and testing out ideas before they are finally implemented is highlighted as a critical stage of the process.

CLIMATE FOR CHANGE

Any organization wanting to become more creative needs to be aware of the necessary conditions for creativity to thrive. Majaro (1992) suggested three prerequisites. These are:

- 1 The right climate.
- 2 An effective system of communicating ideas.
- 3 Procedures for managing innovation.

MANAGING CHANGE SUCCESSFULLY

To get change in an organization introduced successfully it is suggested that one should:

- React quickly to change. You need to think in a creative and innovative way.
- Accept that dealing with a continually changing situation is a normal part of your job. Don't bury your head in the sand when new or different problems arrive.
- Maintain a well-informed knowledge of developments in your industry or profession.
- Monitor the environment for signals, trends and developments in the attitudes and behaviour of competitors, customers and the market.
- Stimulate a positive attitude to change by regularly discussing new ideas and issues with colleagues.
- Encourage your staff to raise issues affecting their work.
- Discuss future plans and issues with your staff both individually and as a group, on a regular basis.
- Communicate internal changes to your staff unless there is good reason not to do so in the short term.
- Be experimental and flexible in your approach to people's ideas.
- Try out new techniques and ideas whenever appropriate.
- Mobilize staff quickly and boldly, but in a coordinated fashion.
- Create a working atmosphere in which ideas and issues do not fall between bureaucratic cracks.

A firm in which the climate is either hostile or indifferent to ideas is unlikely to be creative. But what is the right climate? First, the organization must be prepared to finance creative ideas. It is also very important that top management should encourage creativity at all times. Negativity has to be avoided at all costs. If those at the top do not take creativity seriously, they send out messages to others in the organization who will also tend to accept the same perspective. In an organization without good communications good ideas can be lost simply because people do not know who to inform about their ideas.

Old behaviour and attitudes are often deeply imbedded in the (comfortable) relationships that have been built up over the years. Any significant change generally suggests an upset or reshuffling of these relationships, and a change of one's position relative to others in the workplace. It appears that new thinking and new behaviour patterns are most readily and firmly established when they are conditions of regular membership in a new group, for group members exercise the most powerful tool for shaping behaviour.

QUESTIONS

- 1 A firm is trying to get its employees to participate in a new job-enlargement scheme. Indicate the difficulties that might be encountered when trying to implement such a scheme. Outline the mechanisms that can be used to help deal effectively with such problems.
- 2 An organization is experiencing problems in implementing a new computer-based information system in its finance department. Illustrate how a cognitive mapping device might be used to help gain insights into this problem.
- 3 Discuss the problems encountered in implementing ideas and indicate the various ploys that can be used to help get around these problems.
- 4 Machiavelli wrote: 'there is nothing more difficult to take in hand, more powerless to conduct or more uncertain in its success than to take the lead in the introduction of a new order of things because the innovators have for enemies all those who would have done well under the old conditions and lukewarm defenders in those who may do well' (*The Prince*, Ch. 5). Discuss the implications of Machiavelli's thinking for the implementation of ideas. What steps can be taken to try to circumvent some of the difficulties that might arise in the way that Machiavelli suggested?
- 5 A firm is trying to get its employees to change their operating procedures to improve efficiency in the workplace. What kind of difficulties might be encountered when trying to implement such a scheme? Indicate what you would do in order to deal effectively with such difficulties.
- 6 Getting good ideas adopted by management can often pose problems. Indicate the nature of the problems and outline the mechanisms that can be applied to overcome the difficulties presented by the problems.
- 7 A firm is trying to get its employees to join a new pay scheme. Indicate the difficulties that might be encountered when trying to implement such a scheme. Outline the mechanisms that can be used to help deal effectively with such problems.

CASES

The Northern Bank

The CEO of the Northern Bank is concerned about the ability of the bank to give the type and quality of services that its customers require. He feels that the branch managers and their staff are coming under too much pressure to enable them to do their jobs properly. The branches have to be involved in all aspects of banking and operate at the sharp end of the business. Many of the jobs and operations that are performed at branch level are becoming increasingly expensive to operate, difficult to perform and need to be looked at in detail. The processing of routine activity takes up a good deal of the work and costs, and less than 30 per cent of time and money is put into improving customer relations and the marketing of services. Moreover, the nature of the marketing task has become increasingly complex. Not only does the organization have to market itself to its customers, but also the management of the organization has to engage in extensive internal marketing to gain the commitment and cooperation of staff in providing the kind of customer service the bank thinks desirable. Moreover, the CEO feels that the requirements of personal customers are now too wide and too costly to be fully met by every branch.

In essence, the CEO believes that the bank must be able to deliver to its customers the kinds of services and products that they want if it is to stay in business and return satisfactory profits. Furthermore, he does not believe that the onus of this task should be the sole responsibility of the senior management or the bank's marketing staff. Achieving the required profile demands the support of the whole of the bank's staff.

Questions

- 1 How would you define the problem in this case?
 - 2 What ideas can you think of that may lead to a solution to the problem?
 - 3 Evaluate the ideas that you develop.
 - 4 What problems would you expect to encounter in implementing these ideas? How would you try to overcome these problems?
-

Re-siting the sorting office

Green Star Parcels operates a parcels delivery service from its base in West Bromwich. Opened in 1993, during the first three years of operation the firm grew rapidly from employing ten people on sorting to over fifty by late 1996. During the first three years of operation labour relations were good, but during the past three years they have somewhat soured owing to a number of wildcat strikes, mainly on issues regarding pay and conditions of work. 95 per cent of those engaged in sorting are members of a trade union.

The company operates a three-shift seven-days-a-week operation and guarantees next-day delivery on 90 per cent of its business. Because of the wildcat strikes, however, its delivery reputation has recently become somewhat tarnished.

Late in 1998, largely because of the continuing troubles (but not actually giving this as the reason for change), the company decided to re-site its operations at three new depots in the West Midlands and close the existing one. The new depots were close enough to where existing workers lived to enable most of them to retain their jobs and be employed at one or other of the depots. The company felt that it could take on additional workers since the actual demand for its services was far outstripping its capacity, despite the recent adverse publicity it had been receiving. It felt that by splitting up the workforce those with a tendency to create trouble would be fewer in number on any one of the sites.

Question

Draw up a plan of action to implement this project. What do you consider to be the most important aspects that management should bear in mind?

Outsourcing services

The city council has decided to outsource its office cleaning services in an attempt to save costs and reduce council tax bills. Private contractors have put forward a scheme whereby cost savings of around 20 per cent can be achieved and at the same time guaranteeing employment for 90 per cent of the current staffing levels. The director of the city council and her colleagues are keen to push ahead with the project as part of a general programme of cost reduction within council expenditure. A survey conducted by the management of current staff concerns over the subject of outsourcing indicated that staff had many concerns over job security and pay and conditions resulting from any changes that might take place.

Question

How would you advise management to set about implementing the proposed changes?

Further reading

Klein, K. J. and Knight, A. P. (2005) Innovation implementation: overcoming the challenge, *Current Directions in Psychological Science*, 14: 243–246.

Vandenbosch, B. and Saatcioglu, A. (2006) How managers generate ideas and why it matters, *Journal of Business Strategy*, 27(6): 11–17.

Computer-assisted creative problem solving

INTRODUCTION

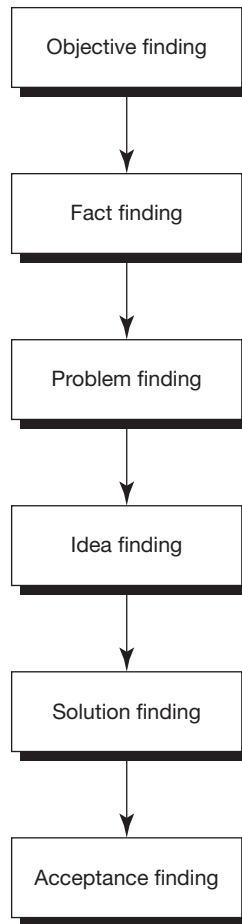
In general, so far, computers have not been specifically harnessed to produce creative ideas and insights for managers by themselves. Rather it has been through the interaction of people and computers that ideas have been produced. There is now a range of computer software which can be used to assist creative problem solving. This stretches from purpose-built software to more general-purpose software which can be used to stimulate creative thinking. In addition, some software is useful for the individual working alone while other software is of benefit to groups of individuals working on a problem or project together. The amount of software available has expanded considerably over the past few years with recent development of applications that will run on hand-held and mini computers fitted with touch screens – commonly referred to as ‘apps’. In the future we may expect to see a greater emphasis on programs that facilitate visualization in one way or another. Developments on the Internet have also led to the setting of social network sites and these to have facilitated the ideation process. Indeed, the very existence of information on Internet sites can act as a spur to ideation. Photographs and videos can act as a spur to ideation and, with the aid of computers, their use can be made in creative problem-solving sessions.

COMPUTER PROGRAMS

‘I think it’s fair to say that personal computers have become the most empowering tool we’ve ever created. They’re tools of communication, they’re tools of creativity and they can be shaped by their user.’ (Bill Gates). Available at: www.brainyquote.com/quotes/quotes/b/billgates173261.html (accessed 28 March 2013).

HISTORY OF DEVELOPMENT

Simon (1985) discussed a computer program called BACON, which he had developed with co-workers. He argued that if a computer program was able to make discoveries which, if made by a human, could be considered creative, then the processes it used should provide useful information about the creative process. The BACON program received raw observational



■ **Figure 15.1**
The stages in CPS covered by this chapter

or experimental data and produced, when successful, scientific laws. Simon wanted to show that scientific discovery is an understandable phenomenon that can be explained in terms of all the same kinds of basic information-processing mechanisms that account for other forms of human problem solving and thinking. Simon's efforts were directed at getting a computer to undertake creative problem solving by itself.

Computer-aided creative thinking and problem-solving mechanisms began to appear in the late 1970s, reflecting some of the ideas of Rogers (1954), Maslow (1954) and Kelly (1955). Rogers and Maslow had argued that self-discovery might lead to creative insights, while Kelly had suggested that the loosening of constructs produced the same results.

Rokeach (1979) put together a computer program that enabled individuals to examine their own value systems and clarify their knowledge. Planet (designed by Shaw, 1982) was a later program that helped the user to uncover the themes and variations with respect to their

problems. A central component of this latter program was the Repertory Grid discussed by Kelly, and it is this which helped comprehension of the classifications people construct around their experiences and, if required, to reconstruct views on a problem. *COPE* (now the *Decision Explorer*) was devised by Colin Eden (Eden *et al.*, 1983) and was designed to help map the relationship between ideas connecting interrelated sets of problems. It also facilitates cause-and-effect analysis.

A growth in interest in the development of computer programs to aid creative thinking problem solving took place in the 1980s. Brainstorm was typical of a number of programs designed to help people be more systematic in their thinking. Essentially, it was an idea processor working rather like a word processor and a database combined. It permitted the user to type in ideas, or the outline of a plan or schedule, as they came to mind. Subsequently, it allowed the user to reorganize ideas or points entered under any number of headings or subheadings so that the structure of a document, and the user's thoughts, too, could be meaningfully organized.

While the above programs assisted in making the users more aware of their own thought processes, none facilitated the restructuring of the user's thinking in order to provide a basis for creative thought. The fact that people understand their thought processes and can organize them in a systematic way is not always a sufficient condition to encourage the generation of creative insights. Kelly (1955) had argued that it was first necessary to go through the process of deconstructing existing thought patterns before one could hope to gain any insights into a problem.

Some of the programs developed in the 1980s attempted to introduce mechanisms that would help people to destructure and restructure their thinking. Brainstormer, for example, was such a program and, using the morphological approach, divided a problem along major dimensions or themes. It presented a structured approach to creative problem solving and facilitated three-dimensional morphological analysis. Creators of computer-assisted creative problem-solving aids adopted different approaches. One such approach was reflected in the Idea Generator. The program encouraged the user to employ a fairly wide range of analogical reasoning methods. Methods included asking the user to relate similar situations to the problem, thinking up metaphors for the situation, and developing other perspectives. The program also included sections that helped people focus on goals and on the reverse of goals. In addition there was a section that helped the user to evaluate ideas.

Several of these early programs attempted to take people through a number of stages of the creative problem-solving process (e.g. Idea Generator), while others made specific use of the computer's ability to randomize events or help in recording and restructuring ideas. Some of the programs facilitated more than one of these features. In very recent times the advent of tablet computers and growth of interest in writing apps for these machines has led to cheap programs becoming available that will perform a number of the techniques covered in this book.

STRUCTURED APPROACH TO CREATIVE PROBLEM SOLVING IN COMPUTER PROGRAMS

To be of assistance, the computer-assisted techniques should have the following features:

- 1 Facilitate movement through any or all of the stages of creative problem solving (i.e. problem definition, idea generation, idea evaluation, etc.).
- 2 Provide mechanisms that stimulate thought.
- 3 Provide a structuring framework within which to define problems, generate or evaluate ideas.
- 4 Facilitate or improve the use of conventional creative problem solving aids.

TYPES OF COMPUTER-ASSISTED STIMULI

Purpose-built creative solving programs are not the only way of stimulating creative thinking with the aid of a computer. There are other ways in which computers can assist in this process. The various ways of classifying computer-assisted creativity stimuli are summarized in Figure 15.2.

Let us look at some of the recent trends that have taken place.

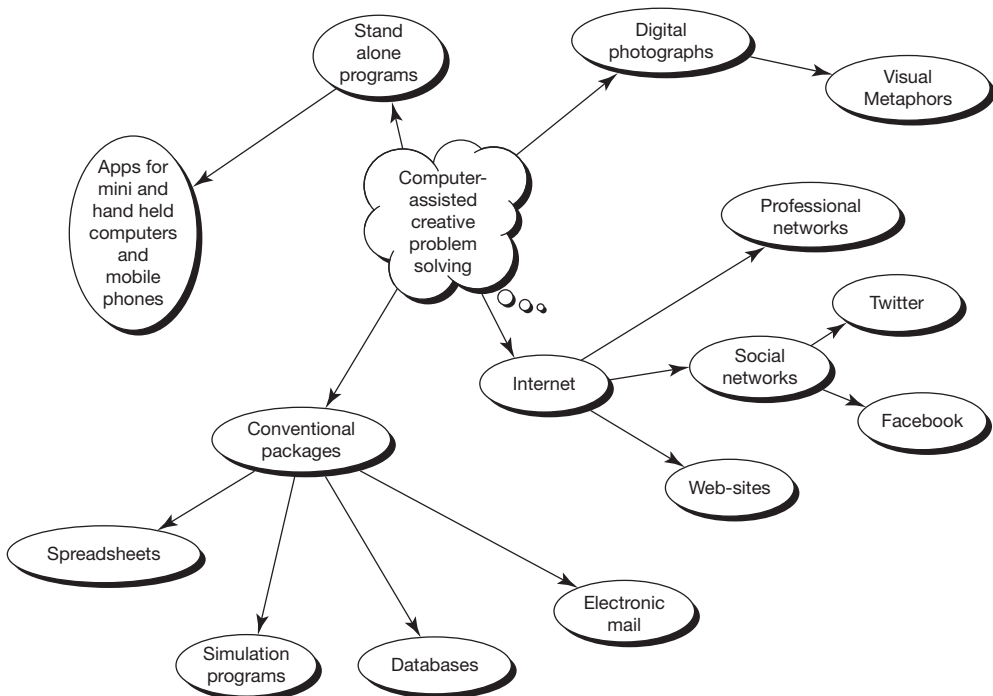


Figure 15.2

An overview of the ways in which computers can help in the creative thinking process

Recent trends in stand-alone programs

Computers have evolved over time into machines that differ radically from one generation to the next. The current trend in machines is towards portability and ultra-compact machines with touch-screen keyboards and voice control. At the same time the computer industry has been quite effective in being able to keep the price of its software comparatively low.

There are software titles that will be very useful to people keen on using some of the standard techniques described in the book. Storyboarding as described in the earlier part of this chapter is one such technique for which there is software available. There is also software that, while designed for writing stories per se, also helps with the use of the Storywriting techniques (also described earlier in the chapter). Essentially, such software helps to get stories started and provides plots, endings and even characters. There are also visual stimuli programs involving dice with images on each one of the six sides of the dice. One rolls the dice and arranges the images shown into a sequence around which one can create a story.

There are also electronic sticky notes and boards, and similar programs which are useful substitutes for flip charts and can be used with most of the group of creative problem techniques that need such a facility to record and display ideas.

There are also programs that imitate the creative problem-solving tools specifically. In one application the ideas behind TRIZ are expounded.

These represent just some of the current offerings. The rate of development of all this kind of software is far too prolific for this book to provide a realistic overview. Moreover, applications appear on the Internet and then disappear or are replaced by something else. Rather than listing specific programs here, readers are urged by me to look for themselves on the 'app' pages for different machines.

The Internet as a medium for ideation

Worldwide communications, including the Internet, are good ways to bring people together for sharing ideas. Internet access offers facilities for bringing people together in a virtual meeting room and aid the generation of ideas and discussion. Meeting-room technology transforms the way people meet, improving the performance of people and the organization. It can be used for brainstorming, problem solving, team building, strategic planning and interactive learning.

Electronic brainstorming is argued to be a better technique than verbal brainstorming or nominal groups (Dennis and Valacich, 1994). The technique permits one to take advantage of working by oneself, thereby reducing the risk of blocking, but at the same time has the advantage of benefiting from inputs of the other group members. It is also maintained that the novelty of technology appears to make up for the cognitive inertia that characterizes information overload in the productivity of groups.

Facebook and Twitter

The growth of Internet social network groups such as Facebook and Twitter has led to a new way of creating and sharing ideas. One can work with a circle of friends or associates based

anywhere on earth where one can get Internet access. Formal idea generating with other members of the group or simply exchanging views or advice can lead to insights into problems in hand. In 2011 there were over fifty million such groups on Facebook. People are using groups to communicate with many of the important communities in their lives, such as their families, best friends and team-mates (Lynde, 2011).

Twitter offers not only the opportunity for interactions with one's group of friends or associates, it also enables one to pick up ideas from various corporate organizations and media creators such as *The Guardian* and *The Economist*. Regular tweaks of interface can be followed. Potentially, Twitter is a useful tool to make use of when it comes to getting and sharing ideas. Just by reading tweets of others one can set off creative lines of thought. Marketers are interested in getting ideas about trends and topics of interest that they can use to their advantage in promoting their goods and services. Social networks such as Twitter, Facebook and the professional network LinkedIn are excellent sources from which this kind of information can be gleaned simply by reading and taking in comments and material which is placed on these websites.

However, it is by being proactive oneself that one can get specific ideas about a subject of interest. In this instance it is not sufficient just to put out a question on Twitter. One should put it to a specific group of people or use popular hash tags to increase the question's exposure. This means that it is important to have built up a well-defined set of people with whom one interacts on a fairly regular basis on Twitter. Another useful approach is to look for tweets that include a keyword/topic of interest along with a question mark (i.e. creativity?). This can make it possible to get a sense of how other people may be interested in the topic. One can try to start tweeting with them about common interests (Brown, 2011).

Crowdsourcing

Howe (2006) describes a web-based business model that solicits the creative insights into problems offered by a distributed network of individuals on the Internet. It does this by openly inviting suggestions. He sees it as outsourcing a task usually carried out by employees of a company to an unknown substantial network of people. Usually, a firm posts a problem online to which a large number of individuals offer solutions. The suggestion which is judged most useful is rewarded and the company makes use of the idea. (See also Chapter 5 regarding the Innocentive website.)

Facebook, too, is seen by some businesses as a medium to use for crowdsourcing. For example, a brewery worked with a social media enthusiast to create a Facebook crowdsourcing campaign. The campaign asked for opinions on what a good beer should taste like. By voting on ingredients like yeast, hops, malt and colour, the respondents essentially helped create a new recipe for the brewery (The Blog, 2013).

Blogs and everyday activities

Creativity has started penetrating into everyday activities due to the vast growth of the Internet. Let's take an example of a person cooking a recipe and posting it on their blog. Thousands of other users looking for a similar recipe come across it and attempt new variations with the

same recipe and post this recipe on the same blog. This in turn stimulates other people and this cycle goes on in an infinite loop. The same thing happens in every field and topic in our everyday life. Thus the Internet and computers have made our lives more creative.

CONVENTIONAL SOFTWARE

Outliners, visual outliner, questioning programs and idea processors

Modern word-processing packages usually have an outliner mode built in. They are designed to help structure one's thoughts when preparing reports, articles or other literary works. Brainstorm was a forerunner of such features, the main idea of which is that one types ideas or thoughts into sections of an electronic page. One can then easily rearrange the sections in whatever order one chooses. It is also possible to collapse the sections to show just the first line. This provides a quick overview of what has been typed in. Rearranging sections with just the first line showing facilitates the construction of a logically ordered document.

There are a number of more expensive commercial programs with sophisticated interfaces which are helpful in terms of helping one to generate insights. These include:

Visual outliners

Several programs attempt to automate the process of drawing graphical outlines, mind maps and concept maps. These programs are useful for presentations and publication. There have been a number of good mind mapping programs produced commercially. Good examples are Inspiration, The Brain and Concept Draw.

Questioning programs

Several programs take input from the user and then present sets of questions, keywords, or exercises to provoke new ideas. IdeaFisher and ThoughtPath (formerly MindLink), for example, both make use of this approach.

Idea processors

There are many different idea processors. Two examples are: the Axon Idea Processor offers a visual workbench with a range of tools to record, process and manipulate ideas. The Idea Generator Plus boosts creative thinking and planning skills by dividing the problem solving process into three logical parts: defining the problem, generating ideas and evaluating ideas.

Visual aids

Strategizing involves problem solving and creative thinking. Eppler *et al.* (2006) discuss and illustrate the benefits that methods that employ graphic representations of strategic content offer for the entire process of strategizing. Among the benefits they note are that it improves problem solving (Vessey, 1991) and inspires creativity and imagination (Buzan, 2003; Morgan, 1986). Visualization facilitates inference processes (Larkin and Simon 1987) and facilitates the decision-making process (Foil and Huff, 1992).

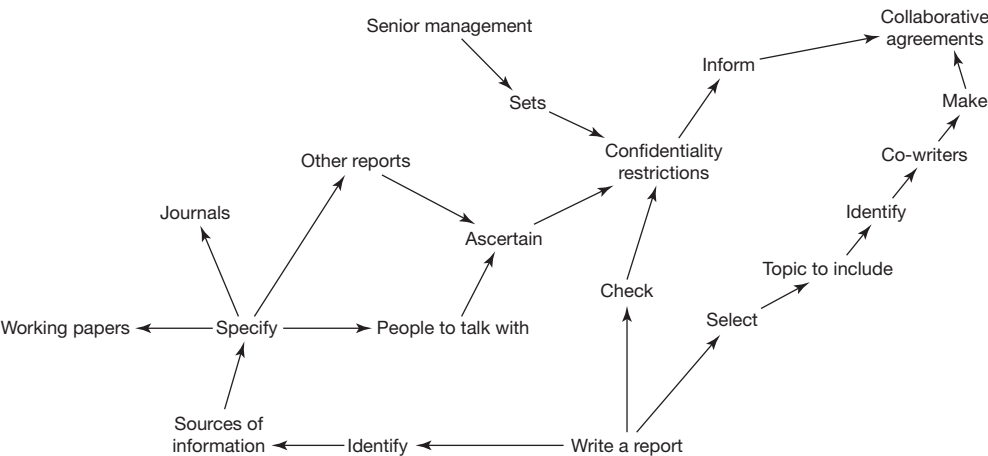


Figure 15.3
Concept map

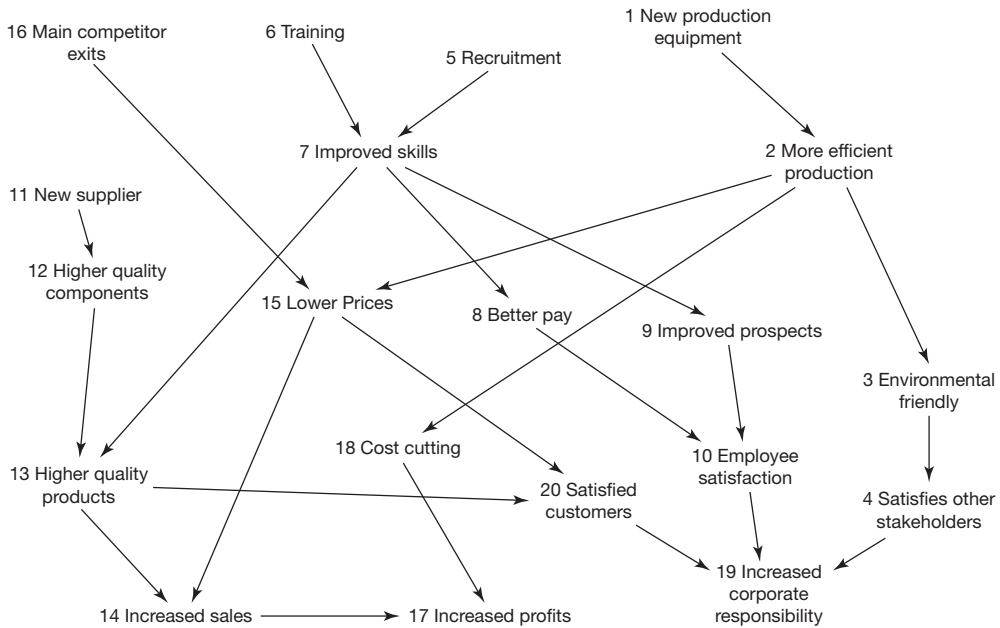
Eppler *et al.* (2006) also propose a framework for visualization in the strategy process and provide examples of typical visual formats that may be used within this framework. For example, one of the elements within the framework involves elaborating on information, discovering new patterns, building a common understanding and developing options. In this connection they note that decision trees, concept maps, mind maps and influence diagrams among other aids are useful.

For example, concept maps comprise linked node labelled with descriptive text (Figure 15.3). The text should contain a word or short phrase representing the concept and similarly labelled links between the concepts. Concept maps facilitate visualizing the connections between ideas and arranging them in a logical structure.

The diagram below (Figure 15.4) models ‘cause and effect with multiple inputs and outputs’ – an ‘influence model’ noted above. This is a more elaborate and sophisticated approach than the Fishbone diagram we noted in Chapter 12. Like the fishbone diagram, it encourages one to look at every aspect of a problem or a topic of interest and to highlight the various relationships. It also helps to establish a logical sequence for handling various parts of a problem in a systematic way. It also enables one to visualize the parts within the whole. However, in this case it recognizes the complex nature of problems and that there may be multiple causes and effects produced. It helps one to identify and trace these multiple causes and effects.

This is a very simple map of only twenty items and it is possible to build up models with hundreds of items. The *Decision Explorer* program, for instance, has routines in it that enable one to trace cause-and-effect chains in the model. In this simple model we can visually trace various chains – e.g.:

11 New supplier > 12 Higher quality components > 13 Higher quality products
And 6 Training > 7 Improved skills > 13 Higher quality products
And 6 Recruitment > 6 Improved skills > 13 Higher quality products

**Figure 15.4***Multiple cause-and-effect map*

The *Decision Explorer* program can rapidly find *all* chains of causes that lead to one effect in very complex models *and* also taking any starting point in the map, examine all the chains of effects it helps to produce. For example, in the latter instance, we can see from visual inspection that:

15 Lower prices > 14 Increased sales > 17 Increased profits

and 15 Lower prices > 20 Satisfied customers > 19 Increased corporate responsibility

Visual analogy

The Internet has many image files that can be easily accessed with a search engine such as Google. These can be used as stimuli for use in the Vision Building technique described in chapter 12. One can also use one's own photographs to stimulate creative thinking in a number of different ways. One possible way is as follows:

One can keep a stock of unusual photographs on a computer. The photographs can be of real events (such as the one used here in the example illustration, Exhibit 15.1). Alternatively, given modern technological help that can be provided by photograph manipulating programs they can be 'manufactured' to give special effects. Such photographs can be used as visual stimuli in the use of visual analogies to get insight into problems. The first step is to select a suitable photograph as an analogy for the problem. Next one needs to create a suitable problem definition which could also be an analogy for a possible problem associated with the picture.



Exhibit 15.1

Visual analogy (photograph by the author)

An illustration of the use of the photograph shown in Exhibit 15.1 might be as follows:

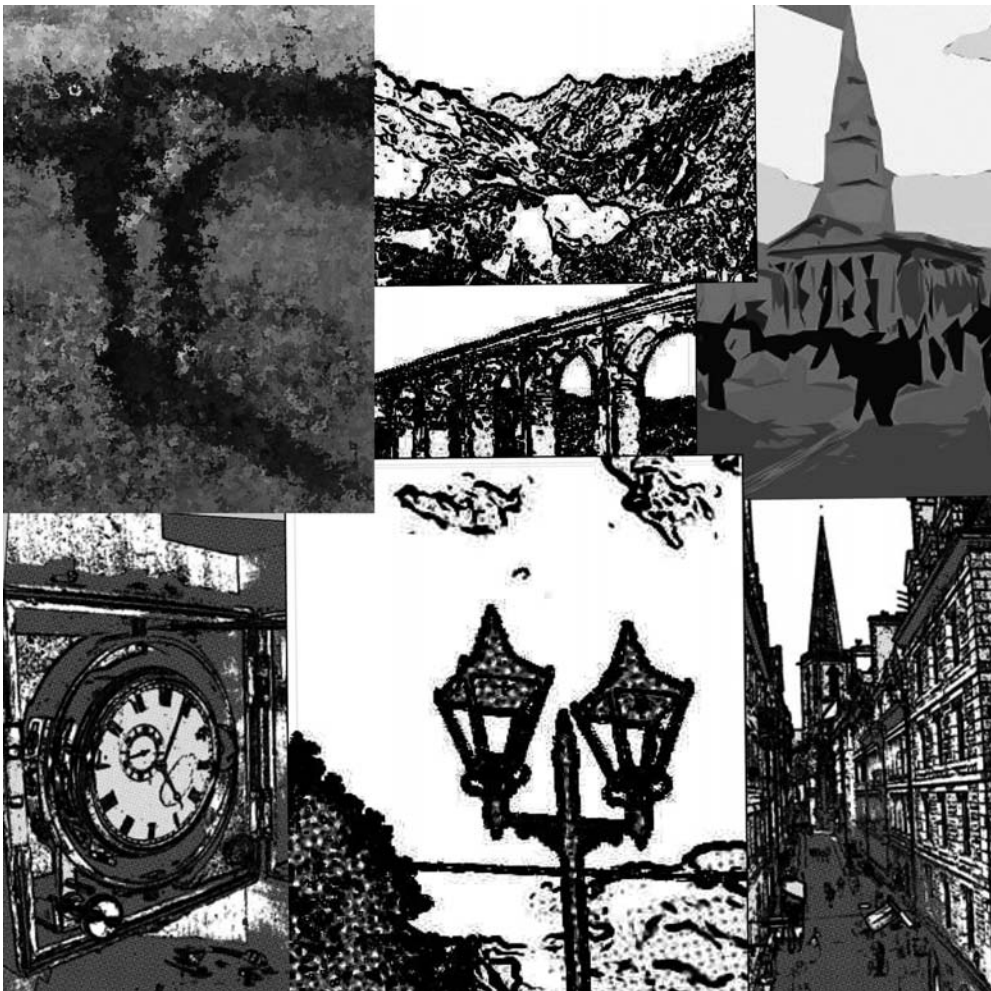
- Problem given: how to get something to work in an inaccessible place.
- Analogy problem: how to set up and light a fire on top of a very large boulder.

Assuming that one is working with a group of people, one might then have the group members generate suggestions for a solution to the analogy problem. These might be suggestions such as:

- 1 Ensure whoever has to climb the boulder is fit and able to do so, and has the necessary climbing aids available.
- 2 Have the person ascending the boulder take up a cord attached to a rope which can be subsequently pulled to the top of the boulder.
- 3 Make best use of the handholds and footholds cut into the boulder to assist with the climb and the task in hand.
- 4 Get a long ladder to lean up against the boulder to make it easier to climb to the top.
- 5 Use a helicopter to drop a person and all the equipment needed on top of the boulder.
- 6 Light a fire on the ground instead.

From each one of these suggestions the group may then be able to reach possible solutions to the problem given as follows:

- 1 Ensure that the person who has to service the equipment has the necessary skills to perform the task without danger to herself or himself.
- 2 Look at the existing facilities that are available and consider the various ways in which they might be used to solve the problem.
- 3 Ensure that at installation there are mechanisms and servicing aids that facilitate access to the problem object.
- 4 Use a tool or resource that can be extended in terms of its reach to help solve the problem.
- 5 Use a mechanical device to help solve the problem.
- 6 Do not install the problem object in an inaccessible place in the first instance.

**Exhibit 15.2**

Collage of seven photographs (photograph by author and altered with computer software)

Visual images that one can take with one's own camera can readily be manipulated with readily available software to present distorted, exaggerated or unusual images. Exhibit 15.2 shows a collage of seven such photographs which have been altered with readily computer software. They present a possible alternative to standard photographs that are used in visualization or other creative problem-solving sessions requiring visual inputs.

Examples

Take one of the photographs (Exhibit 15.3). Suppose the problem is how to shorten the time that we spend on administration. We might take the word 'shorten' as the keyword and ask people to look at the picture and see where 'shorten' might be something that appears relevant. We might start by asking people to list the characteristics of what seems to be featured or suggested in the picture according to how they perceive it that relate to the opposite of our key word. This might elicit such comments as 'high arches, high clouds, high foliage'.

We might then ask in turn 'how might one lower the arches, lower the clouds, lower the foliage?'. This could lead to ideas such as 'dismantle the structure piece by piece and rebuild, get closer to the clouds in an aircraft or balloon so they are closer to you, cut back the foliage regularly so it does not grow so high'.

These suggestions might then be related back to the original problem:

look in detail at our administrative work and see how we might construct it so that it can be lowered;

employ an electronic, mechanical or similar means of dealing with the administration so that the process can be shortened.

Or take another of the photographs (Exhibit 15.4) with the same problem:

In this case we might simply ask people what they see happening in the picture and to express it in as few words as possible. This might lead to such thoughts as: 'shadows, strange figures, flitting about, weird place'.

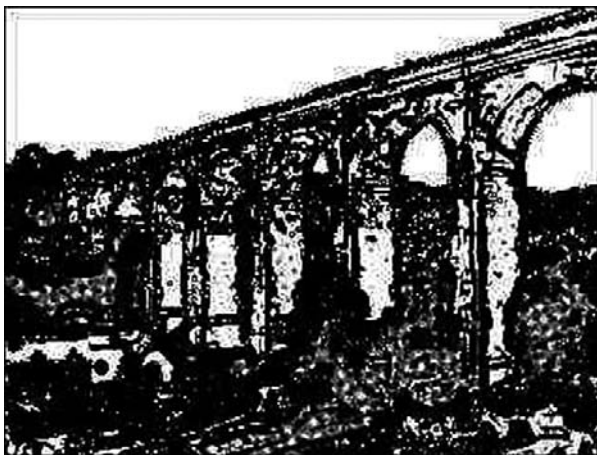


Exhibit 15.3

The viaduct

**Exhibit 15.4***Trafalgar Square*

We might then ask people to take some of these thoughts and combine them into something more meaningful. This might lead to: 'weird shadow-like figures flitting about in a strange place'.

We might then ask how we could make the picture appear how we might actually see it in real life. This might produce suggestions such as 'put colour into, turn the shadows into people or things they actually represent, straighten the appearance of the buildings and features of them, don't distort things so much'.

We might then ask people to relate these thoughts back to the original problem. This might produce suggestions such as 'plan to do the administrative work at time when you might get some enjoyment from doing it, identify what aspects of the work seem burdensome and look at them closely to see if they can really be done in some other way, don't let the administrative work seem more than it really is'. In other words, question your own perceptions of the problem.

There are many ways in which one might use photographs as visual stimuli and create different techniques of your own.

Videos

Personal computer software now enables people to create video material. The material can be recorded with the aid of digital cameras or even with the aid of the built-in camera that is available on computers themselves. The software facilitates cutting up videos into sections and

rearranging or piecing the sections together in different ways. One can also add in sections of other videos and still photographs as well. The resulting new videos that one makes may be used to create different stories or effects. Indeed, one can even just simply put together a selection of still photographs accompanied by a verbal commentary and/or music to represent a story.

These kinds of visual presentations can build a dynamic element into visual stimulation when it comes to stimulating creative thinking. Used in conjunction with a technique such as Story Writing, described in Chapter 12, it may be a fruitful way for a group to gain insight into a problem on which they are working.

One can also just take short videos of particular events and use these as a stimulus for thought in the same way as one might use still photographs. A video featuring a bird searching for food on the ground, cats watching birds, different types of machine in operation, a farm worker ploughing a field, an aeroplane coming into land, birds landing on ice, or literally any kind of event may prove a fruitful source of an idea or insight. Such videos only need to be of short duration.

YouTube on the Internet, of course, is a vast resource of video material and one can search it to find information that might be used as a stimulus for thought. Rights of ownership of the material on YouTube, of course, restrict downloading of the material.

Spreadsheets

Spreadsheets facilitate creative problem solving. Simple or complex mathematical models can be constructed with the aid of a spreadsheet and subjected to sensitivity analysis. This is both a powerful and a simple way of encouraging creative thinking. It encourages people to try out ideas in a risk-free environment and provides a ready-made tool for doing so. Jackson (1985) provided an ample illustration of the use of spreadsheets for this purpose. Here illustrations cover many aspects of business including database management; statistical analysis; survey data; analysis of relationships; sales forecasting; financial planning; cost estimation; budgeting; decision modelling; sensitivity analysis; and simulation. An example of a sensitivity analysis of the net savings to be derived from implementing a project is shown in Table 15.1. Three scenarios are assumed, showing the added costs of the new method as 75 per cent, 70 per cent and 65 per cent of the savings effected on the old method. A projection for four years is shown.

Spreadsheets are also extremely useful in facilitating the other quantitative evaluation of ideas that we covered in Chapter 13. In particular, they are useful in connection with using those that involve mathematical evaluations, such as pay-off tables and decision trees. They can also be used effectively when making evaluations using weighting systems.

Simulation packages

Simulation can be of enormous benefit to an organization. Years ago programs ran on main-frame computers and were used by large corporations to assist in the solution of complex problems. For instance, the Exxon Corporation developed a model of gasoline supply at a refinery that was used to control the inventories of several blends of gasoline and maximize storage-tank utilization. Savings resulting from not building an additional storage tank amounted

Table 15.1 *Scenario analysis (£)*

<i>Scenario 1</i>		<i>Year 1</i>	<i>Year 2</i>	<i>Year 3</i>	<i>Year 4</i>	<i>Total</i>
Savings on old method		75,000	100,000	125,000	200,000	500,000
Added cost of new method	75%	56,250	75,000	93,750	150,000	375,000
Net savings		18,750	25,000	31,250	50,000	125,000
<i>Scenario 2</i>		<i>year 1</i>	<i>year 2</i>	<i>year 3</i>	<i>year 4</i>	<i>Total</i>
Savings on old method		75,000	100,000	125,000	200,000	500,000
Added cost of new method	70%	52,500	70,000	87,500	140,000	350,000
Net savings		22,500	30,000	37,500	60,000	150,000
<i>Scenario 3</i>		<i>year 1</i>	<i>year 2</i>	<i>year 3</i>	<i>year 4</i>	<i>Total</i>
Savings on old method		75,000	100,000	125,000	200,000	500,000
Added cost of new method	65%	48,750	65,000	81,250	130,000	325,000
Net savings		26,250	35,000	43,750	70,000	175,000

to \$1.4 million (Golovin, 1979). In another instance a corporate simulation model was developed for Canterbury Timber Products Ltd to improve planning for domestic and export operations. The resultant ability to explore more alternatives with the model resulted in savings in direct and opportunity costs of at least \$10,000 per annum (de Kluyver and McNally, 1980).

Today there are simulation programs that can be used by anyone who has the time to spend learning how to use them. They can be found by searching online and are relatively cheap to acquire. Simulation packages can be used to enable complex processes in organizations to be modelled. Based upon sampling real data, simulations of activities can be carried out on a microcomputer. It might be difficult, expensive or even dangerous to experiment in the real world with such activities, but on the computer these problems are removed. As in the case of the spreadsheet, people are encouraged to try out their ideas in a risk-free environment.

Simulations are extremely useful for developing different scenarios and can be used in conjunction with the techniques discussed in Chapter 12 relating to scenario building. They are sometimes referred to as 'best-practice' simulations and can be used for various purposes associated with envisaging what things will be like given different estimations of future happenings which will influence outcomes. One can enter numerical values for different parameters and see what effect this will have on outcomes.

The dynamic nature of simulations is one of its most powerful features.

An example of a useful business simulation tool is Vensim. Vensim provides industrial strength simulation software for improving the performance of real systems. There are configurations of the software available for everyone from students to professionals. There are also associated model libraries and tutorials to support learning how to make use of the software. The simulation software adopts the System Dynamics approach which resulted from

the pioneering efforts of Jay W. Forrester to apply the engineering principles of feedback and control to social systems (Forrester, 1961). A good illustration of the use of Vensim can be found in Shahgholian and Hajihosseini (2009).

Databases

A firm's internal records can be scanned to help solve customers' problems. In addition, external databases can be searched for information which has an influence on pending organizational decisions. Essentially, databases are storage facilities for data, information and, most importantly, for knowledge. Existing information in computerized databases can be examined, reassessed and made use of so that it becomes new *explicit knowledge*. Such knowledge can then be put to good use in solving new problems that may arise. For example, many large companies examine point-of-sales data to discover not only what does and does not sell, but also to find new ways to expand their sales. The data held reflects the type of outlets where the sales have been made and profiles of the customers using those stores. This enables the firm to identify characteristics of the shoppers at different stores and what they actually buy. Changes in patterns can readily be recognized and adjustments then made to marketing tactics to enable suitable merchandise to be supplied and apt sales promotions to promote future sales.

Perhaps even more sophisticated is the use of databases for turning *explicit knowledge* into *tacit knowledge*. The latter reflects experience that has been gained by individuals and which would be beneficial to the organization if it could be shared and accessed by all members of the organization. For example, customer complaints could be entered into a database and other members interacting with customers could then use the knowledge it creates to experience for themselves the kinds of things about which complaints have been raised. The search facility on a database can readily list material on the insertion of a keyword.

Electronic mail systems

The use of an electronic mail system for creative problem solving purposes illustrates how a general-purpose computer installation can aid the creative thinking process. It facilitates the informal exchange of ideas but in addition to this when used in conjunction with a database can become a very powerful tool. Emails containing *useful tacit information* can quickly be inserted into a database and become *explicit knowledge* that may be of future use to others in the organization.

Business simulators

Business games were designed as aids to management development and training. They provide a vehicle by which principle and practice can be learned and experienced. Yet the business game also contains something that is vitally important in management but which is seldom found in practice: it allows individuals to take risks and make mistakes; to play out hunches and follow up wild ideas. By their very nature, business games encourage creative thinking and ideas by helping people to overcome some of the well-known barriers to creativity such as the pressure to conform and the fear of looking foolish.

Business simulators offer the opportunity for individuals to test ideas and take risks. They can be made to provide positive feedback when satisfactory decisions or suggestions are made by the user or when creative and sensible suggestions are made. Conversely, negative reinforcers can be employed when rash or uncreative actions or suggestions are made.

Computer-assisted creative problem solving is not eccentric. It has been around now for the best part of twenty years. As one of the early developers of the area, I have a keen interest. The chapter suggests some useful packages.

QUESTIONS

- 1 What do you consider to be the essentials of a creative problem-solving program? Do you think it should provide a structured approach to the whole CPS process or should it just concentrate on one aspect of it?
 - 2 Design a creative problem-solving program which you think could help people to deal with different kinds of open-ended problem.
 - 3 How do you visualize computer-assisted creative problem solving developing in the future?
 - 4 Do you think crowdsourcing is a good idea? Why or why not?
Suggest how you might use Facebook and Twitter to get insights you may want into a pressing problem.
 - 5 If you have access to a touch-screen phone, hand-held tablet machine or a tablet computer, have a look to see how many different apps or programs there are on it that facilitate ideation. Indicate what these are and critically evaluate their usefulness.
-

CASES

A complaints system

A large city council has recently decided that it wants to add a website section to its main website to deal with complaints lodged by users of its services and members of the public. Such a system it believes would serve two purposes:

- 1 It would enable it to deal with the specific complaints raised.
- 2 It would provide a knowledge base for getting to know how to improve services to best fit with user needs and wants.

It believes that many people have access to computers and mobile phones and that they might prefer to leave messages on the council's website rather than phone in or visit a 'One Stop Shop' to speak in person about their concerns.

The council has appointed a consultant to produce a prototype design for such a system and is now awaiting further details. Imagine you are the consultant.

Question

Draw up a document outlining the design for the system that you think the city council might need bearing in mind the specific requirements.

Getting into computer apps

Jane is a keen programmer and is interested in making extra money from writing apps for touch-screen hand-held machines and mobile phones. She is also interested in creative problem solving and feels she knows enough about the subject to enable her to produce the kind of software that people might be interested to buy. She decides to find more about this possibility and asks her friend John what he thinks about the idea. John suggests she should scan the app software for machines like the iPad, iPhone and iPod to get some idea of what people have been producing already. 'That way,' he says, 'you will get some idea of what is on offer, what people think about the apps and what price they sell for.'

Question

What do you think Jane found out when she did what John suggested?

The socialite

Ever since she was a small girl Emily was always talked about as being a bit of a 'socialite'. She had lots of friends in the primary school and even more at the secondary school. She joined Facebook and received over 2,000 emails in the first six months of joining.

Emily is now 18 and has just started studying for a degree in Business Studies at a university more than a hundred miles away from home. She is keen to do well on her degree course and at the same time she wants to get the maximum benefits from all the social activities that are associated with being at a large campus university. She has accommodation on campus but is not allowed to have a car on campus during her first year at university. She does, however, have both an iPad and an iPhone which enable her to keep in touch with people.

Question

Students face all kinds of ill-structured problems when they leave home and go to university, and it can be quite difficult for them during their first-year studies. Given Emily's personality and resources, how would you advise her to make use of (or not make use of) the resources she does have available?

FURTHER READING

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Case example of the creative problem-solving process

GREAT NORTHERN BUS COMPANY

The Great Northern Bus Company is based in Newcastle upon Tyne and runs regular services to other parts of the UK. The company defines its competitors as all carriers of passengers to all parts of the United Kingdom. The company is forward looking and recently appointed you as a consultant to advise on how it might get to grips with the current problems it faces. These are summarized by the marketing director as follows:

Recently we have experienced a drop in sales and loss of market share in our long distance business and we need to find ways to improve our position. We desperately need some good ideas and a specific plan of action to help us get to grips with this problem. Can you advise, or better still see, what solutions to our problem you can come up with?

You, of course, want to help and decide that the best way is to make use of the creative problem-solving process in which you are an expert. As a first step you decide to gather a small group of personnel with interest and expertise in the subject together to start the process rolling.

You start with *objective finding* and ask the group to defer judgement and list some major concerns in the company. The following list is generated:

- 1 Recruitment of more qualified personnel.
- 2 Improved customer service among long distance passengers.
- 3 Increasing market share.
- 4 Better prediction of customer responses to marketing.
- 5 Developing a marketing slogan.
- 6 Improving manager–subordinate relations.
- 7 Reducing promotional costs.
- 8 Improving target market identification.
- 9 Determining customer preferences.
- 10 Improving focus group procedures.

Next you identify 'hits'. This is a subjective process and varies from company to company and from person to person. In this case suppose the company identifies items 1, 2, 4 and 9. Items 2, 4 and 9 clearly represent hotspots concerning customers. If the group members agree, they might identify an objective involving customers.

To identify this area, they apply the criteria of ownership, priority and critical nature. They decide they have ownership over all the hits, since customers are a prime marketing responsibility. Of the hits, they decide that item 2 (improving customer service among long-distance passengers) has higher priority than the other hits, since it is more likely to affect financial profit. (Remember, this was the concern of the marketing director.) It is also critical because an improvement in the financial position is critical and there is a definite need to increase market share. Improved customer service may result in more customers (or repeat business) and therefore more profit.

After reviewing the hits and applying the criteria, they decide on the problem statement: 'IWWM improve customer service for the long distance passengers?' They are now ready to move on to the next stage – *fact finding*.

FACT FINDING

The purpose of this stage is to generate relevant data to improve understanding of the problem. This in turn allows you to consider different problem perspectives. To search for data systematically the group uses the 5 W's method. They generate a list of Who? What? Where? When? and Why? questions and answer them as follows:

Who are the potential customers?

- The long distance travellers
- People on business
- People on vacation/holiday
- People combining business and pleasure
- Frequent travellers
- People visiting families
- Males and females
- Young and old people
- Rich and poor people
- People travelling with other bus companies

Who provides customer service?

- Couriers
- Ticket counter personnel
- Catering personnel
- Drivers
- Maintenance staff
- Travel agents

What is customer service?

- Learning customer preferences
- Attending to customer needs
- Solving customer problems
- Anticipating problems before they occur
- Interacting with customers with a positive attitude

Where is customer service most evident?

- During journeys
- When delays occur
- At ticketing counters
- When any other problem affects customers
- During peak travel periods

When do most people notice customer service?

- When they are ignored
- When someone goes out of his or her way to help
- When they receive prompt attention
- When an employee overlooks a minor policy to help someone in trouble

Why is good customer service important?

- It helps to attract new customers
- It helps to retain old customers
- Sustained profits depend on it
- It helps the company project a positive image
- It creates satisfied customers who are more likely to travel with us again

The group members then converge and identify hits among the fact-finding data. To do this they underline the most important responses to the questions and list the results. For example:

- The long distance traveller
- People travelling with other bus companies
- Couriers
- Drivers
- Ticket counter personnel
- Learning customer preferences
- Anticipating problems before they occur
- During journeys
- When delays occur
- When someone goes out of his or her way to help

- When they receive prompt attention
- It helps attract new customers
- It helps retain old customers
- It produces satisfied customers
- It helps the company project a positive image

Next the group examines the hits to see if might group some together as hotspots. The group members develop the following list:

Employees

- Couriers
- Ticket counter personnel
- When someone goes out of his or her way to help

Customers

- The travelling public
- People travelling with other bus companies
- Learning customer preferences
- It helps to attract new customers
- It helps retain old customers
- It produces satisfied customers

Travel related data

- During journeys
- When delays occur

PROBLEM FINDING

The group now is ready to enter the *problem-finding* stage to consider a variety of problem perspectives. Restating the problem might unlock a new viewpoint that could lead to many creative solutions. To create these viewpoints, the group examines the fact-finding hotspots and uses the hotspots to generate possible problem redefinitions. The group members generate the following list of problems.

In which we may

- 1 encourage employees to go out of their way to help customers?
- 2 attract passengers who regularly travel with other bus companies?
- 3 attract new customers?
- 4 increase long-distance traveller customer satisfaction?
- 5 reduce the number of departure delays?

Next they converge and identify hits using the criteria of ownership, likelihood of stimulating many ideas, and freedom from criteria. After analysing all the statements, they select problems 1, 3 and 4. Of these they decide that problem 4 is most likely to resolve their objective of improving the company's financial position. The primary reason for this choice is one of ownership. Their marketing data suggests that the long- distance market is the most unstable because no bus company has established itself in a dominant market position, as is the case with short-distance travel. Thus, they may be able to capture a larger market share and improve their financial position.

IDEA FINDING

The group is now ready to begin *idea finding* using the problem ‘IWWM increase long distance traveller satisfaction?’ The members start with a purge to list more conventional ideas:

- install more comfortable seats
- offer good entertainment
- provide more leg-room
- train personnel to be more courteous
- lower ticket prices

Next they select a formal idea generation technique such as the two words method to implement the approach. To implement this approach, they follow these steps:

- 1 List alternative word meanings for two keywords in the problem statement.
- 2 Examine combinations of two words, one word from each list.
- 3 Use combinations to suggest ideas.

For instance, they might focus on the words *increase* and *satisfaction* and set up the technique as follows:

<i>Increase</i>	<i>Satisfaction</i>
Improve	Pleasure
Enlarge	Ease
Enhance	Enjoyment
Renew	Peace of mind
Upgrade	Contentment

Different combinations of these words suggest such ideas as:

- Gourmet food (upgrade—pleasure)
- Seconds on food and drink (renew—satisfaction)
- Free travel insurance (upgrade—peace of mind)
- Better seats (enhance—enjoyment)
- Shortening ticket-buying queues (improve—ease)

After generating these and other ideas, the group might try another technique such as brainwriting. Brainwriting is a brainstorming variation in which a group generates ideas silently and in writing. The steps for this method are:

- 1 Each group member is given a stack of index cards.
- 2 Each member writes down one idea per card and passes it to the person on the right.
- 3 The person receiving a card examines the idea on it for possible stimulation of a new idea.
- 4 Members write down (on another card) any new ideas suggested and pass the card to the person on the right.
- 5 After about ten minutes of this activity, the idea cards are collected and evaluated.

Some possible ideas from this technique are:

- Video-cassette players built into seat backs.
- Free snacks.
- On-board business card raffles.

In this example, the group has generated a total of twenty ideas for improving passenger satisfaction. Group members now need to converge, identify any hotspots and select idea-finding hits. For hotspots, they identify:

- Travel comfort (e.g. more comfortable seats, more leg-room).
- Food enhancements (e.g. gourmet food, free snacks).

To select hits from among these hotspots, they decide upon three criteria: cost, ease of implementation and likelihood of increasing passenger satisfaction. After examining all the ideas and applying the criteria, they reduce the list of twenty ideas to two:

- 1 More comfortable seats.
- 2 Video-cassettes built into seat backs.

The group is now ready to move to the next CPS stage and select a final problem solution.

SOLUTION FINDING

Solution finding contains two sets of divergent activities. First, the group generates evaluative criteria:

- 1 Cost.
- 2 Time to implement.
- 3 Degree to which current equipment will require modification.
- 4 Effect on routine travel operations.
- 5 Acceptance by bus crew.
- 6 Passenger long-term interest level.
- 7 Ability to interest a broad cross-section of passengers.

The second divergent solution-finding activity is to improve the ideas from idea finding. In this case the group members decide that the ideas don't need improvement and move on to convergent solution finding.

Of the seven criteria they generated, the group members decide to delete criteria 2 and 5. They then construct a weighted decision matrix (Table A1.1). This allows different weighting for each criterion; thus, cost may be seen as more important than acceptance of an idea by a bus crew.

Table A1.1 *Weighted decision matrix*

<i>Criteria</i>	<i>Criteria importance</i>	<i>More comfortable seats</i>		<i>VCRs in seat backs</i>	
		<i>Idea score</i>	<i>Subtotal</i>	<i>Idea score</i>	<i>Subtotal</i>
1 Low cost	5	2	10	3	15
2 Equipment modification	5	1	5	2	10
3 Routine travel operations	4	2	8	3	12
4 Passenger interest level	4	3	12	5	20
5 Interest to cross section	3	3	9	5	15
Totals			44		72

The group rates each criterion on importance, using a five-point scale (1 = not very important; 5 = very important). Next, each solution is rated on the degree to which it satisfies each criterion. The lower the number, the less the criterion is satisfied. For instance, more comfortable seats were rated a 2 on the criterion of low cost. This means the group believes they will be relatively expensive. (Cost is always a confusing item since low cost will receive a high rating.) Finally, they multiply the criterion ratings by the ratings for each solution ('idea score') and sum the products (subtotal). For instance, they multiplied the criteria importance rating of 5 for low cost by the rating of 2 for more comfortable seats and recorded a response of 10 as the subtotal. Then they summed the products in each column. As shown below, they rated VCRs the higher of the two options. In this case, however, the group decides to select VCRs.

ACCEPTANCE FINDING

It is not enough to select the best solution. Steps must also be taken to ensure the solution can be implemented successfully. This requires consideration of implementation obstacles and ways to overcome them.

A systematic way to ensure effective implementation is to conduct a potential problem analysis (PPA). Although different versions exist, the PPA used here was developed originally by Kepner and Tregoe (1976) and later modified by Van Gundy ([1981] 1988). The steps for conducting a PPA are as follows:

- 1 Generate a list of potential problems that might hinder solution implementation.
- 2 Select the most important problems and list the possible causes of each.
- 3 Rate the probability of occurrence of each (1 = not very probable; 5 = very probable) and the seriousness of each (1 = not very serious; 5 = very serious).
- 4 Multiply each probability rating (P) times each seriousness rating (S) to obtain a PS score.
- 5 Generate preventive actions for each problem cause.
- 6 Rate the residual probability (RP) that each problem cause still will occur after a preventive action has been taken.
- 7 Multiply the PS score by the RP score.
- 8 Develop contingency (back-up) plans for causes with the highest $PS \times RP$ scores.

An example of a PPA using the VCR is shown in Table A1.2. There are two problems with three causes each. The group estimates that all the preventive actions will reduce the probability of occurrence of each cause. For instance, equipment failure owing to lack of maintenance is reduced from a probability value of 3 to a 1 after the preventive action of checking the VCRs after every trip. Group members then multiply the PS ratings by the RP ratings to determine which causes should have back-up or contingency plans. In this case, the most important area seems to be equipment failure owing to misuse. If built-in 'help' functions do not prevent misuse, they suggest a computer diagnostic program that automatically signals potential misuse. If the group wanted, it could also have developed contingency plans for the other, more highly rated causes.

The last acceptance-finding activity involves developing an action plan to guide solution implementation. A useful way to structure this plan is to use the five Ws questions of Who? What? Where? When? and Why? For instance, they might ask such questions as:

- Who will be responsible for implementation?
- What will they implement?

Table A1.2 Example of a potential problem analysis (PPA)

Potential problem/ causes	P	S	Preventive actions	PS	RP	PS × RP	Contingency plan
1 Equipment failure							
(a) Heavy use	4	5	Use industrial equipment	20	2	40	Computer diagnosis
(b) Misuse	5	5	Built in help	25	2	50	
(c) Lack of maintenance	3	5	Check after every journey	10	1	10	
2 Passengers do not know how to use equipment							
(a) Unfamiliarity	2	3	Instructional video/film	6	1	6	
(b) Poor instructions	5	3	Write own instructions	15	1	15	
(c) Not user friendly	5	4	Test with passenger sample	20	2	40	

- Where will they need to go to implement it?
- When should it be implemented?

The Why? question can be used by asking ‘Why?’ of all the other questions – that is, asking why a particular person (or persons) should be responsible for an implementation activity (Who?); why a particular thing should be implemented (What?); why it should be implemented in a particular location (Where?); and why one time rather than another would be better to implement it (When?). This stage ends with a sequential listing of specific action plan steps. For instance, the group might want to survey customers, then contact VCR manufacturers and take bids, consult with engineers on installation problems, rewrite instructions if necessary, and so forth.

After implementation, the only remaining CPS activity is to follow up the effectiveness of the solution. In this instance, the group would want to know if it has solved the original problem of increasing passenger satisfaction. If so, the next task would be to relate improved satisfaction with increased revenues from ticket sales.

Notes on problems

CHAPTER 1

Doppler system

In the Doppler system of aircraft navigation two beams of radio waves are aimed at the ground from transmitters under the fuselage, the forward beam striking the ground slightly ahead of the aircraft and the back beam slightly astern; both alternate twice each second from port to starboard. The forward beam signals reflected back to the aircraft are increased in frequency in proportion to its speed over the ground, the back beam signals decrease. The difference in frequency is measured automatically to give the navigator an accurate indication of the speed of the aircraft and of the drift angle so that the course can be corrected accordingly. This in turn has led to the development of automatic flying and landing devices. The first pilotless aircraft successfully completed an Atlantic crossing as long ago as 1947.

Tank refurbishers

Instead of cutting off both ends of a tank only one end needs to be removed. Cleaning and painting can be performed adequately in this way. It also saves the cost of rewelding both ends of the tank.

Keeping prices competitive

Organizations can often disguise price rises, permanent or temporary, by making it appear that no price rise is in fact occurring. This can be achieved in any one of the following ways:

- 1 The discount structure can be altered so that the total profit to the company is increased but the list price to customers remains the same.
- 2 The minimum order size is increased so that small orders are eliminated and overall costs thereby reduced.
- 3 Delivery and special services are charged for.
- 4 Invoices are raised for repairs on purchased equipment.
- 5 Charge for engineering, installation and supervision.
- 6 Customers are made to pay for overtime required to get out rush orders.

- 7 Interest is collected on overdue accounts.
- 8 Lower margin models in the product line are eliminated and more profitable ones sold in their place.
- 9 Escalator clauses are built into bids for contracts.
- 10 The physical characteristics of the product are changed – e.g., it is made smaller.

Price and innovation

Unless Sally feels confident that her firm can take on the role of market leader, it would probably be better to hold prices steady – but there may be more creative solutions!

CHAPTER 2

Perceptual block

There are, in fact, 18 occurrences, but most people do not get it right first time despite having at least two chances to read through and count the occurrence of the letter.

Why are 2013 coins worth more than 2007 coins?

Because there are more of them – 12 more to be precise.

The clock problem solved

Hint: normal sum of clock numbers $1+2+\dots+12 = 78$ not divisible into whole numbers when divided by 4. Need to artificially find an extra 2. The answer usually involves reversal of the IX (or IV if this is used instead of IIII).

CHAPTER 3

Chessboard problem

The mutilated chessboard problem was a tiling puzzle proposed by philosopher Max Black in his book *Critical Thinking* (1946). He asked whether it was possible on a standard 8×8 chessboard to remove two diagonally opposite corners, leaving 62 squares and to place 31 dominoes of size 2×1 so as to cover all of the remaining.

The answer to this puzzle is no. Placing a domino on the chessboard will always cover one white square and one black square. As a result, dominoes will cover equal numbers squares of each colour. Removing the two white squares will not leave an equal number of black and white squares. Thus, it will not be possible to cover all the squares.

The same proof shows that whenever any two white squares are removed from the chessboard it will not be possible to cover all the remaining squares.

See the following:

Gamow, G. and Stern, M. (1958) *Puzzle-Math*, New York: Viking Press.

‘Gomory’s Theorem’ from the Wolfram Demonstrations Project, available at: <http://demonstrations.wolfram.com/GomorysTheorem/>; contributed by: Jay Warendorff (accessed 17 April 2013).

CHAPTER 4

Problem solving and decision making in a crisis

The central problem is that if the dam breaks down, the people in Oldenborough will be flooded.

Many problems and decisions must be made to address this problem. Some of the key problems and decisions are:

- Should residents in the city be evacuated?
- Are there some parts of the city where it will not be necessary to evacuate people?
- If the decision is to evacuate is taken, when should the evacuation take place?
- Who will notify the citizens of the evacuation, and how will this be accomplished?
- What will be required in the way of additional resources will to accomplish the evacuation and provide any shelter required?
- What is the most effective way to keep the dam from collapsing, and what resources will be needed to accomplish that?
- What action should be taken if the dam starts to collapse and water floods through?
- How might early decisions affect later decisions?

CHAPTER 6

Seven letters problem

SUPERMARKET

Parcel delivery problem

Reducing the number of sorters, introducing a clear system of coding to identify relevant delivery vans, and training sorters on how to implement such a system.

CHAPTER 8

Reducing wear and tear

In order to reduce the amount of resurfacing work on motorways the white lines should be repositioned every few years. Resurfacing costs, it was estimated, could be reduced substantially as a result since repair work would need to be done at considerably longer intervals.

CHAPTER 9

Points about ‘Challenging assumptions: what can we take for granted?’

Total expense would go up after outsourcing components because fixed costs had not been reduced, but one still had to pay suppliers for components. The assumptions must also include either that the fixed cost can be reduced (e.g. plant, machinery, etc. sold off, etc.) or that fixed costs are relatively small in relationship to the savings that can be achieved by outsourcing. Outsourcing only some of the components means that the remaining components still produced by the company must now shoulder an increased overhead of fixed costs, thereby making the possibility of outsourcing these components a more attractive proposition.

Over-utilization of assets, such as assembly plant, leads to the creation of extra inventory and not extra sales. Inventory absorbs overheads and is shown as an asset in the balance sheet and can therefore give a misleading picture of the company’s financial position.

The CEO resigned because he must have known the true state the company was in. Subsequently, many thousands of workers were laid off and the company nearly went out of business. The build-up of inventory, given a significant increase in demand for the firm’s products, might have resulted in a favourable situation for the company as its inventory would have transformed into sales and generated cash flow and profit. Any other scenario was a recipe for disaster.

ANSWERS TO IN-TEXT PUZZLES

Puzzle 9.1. answer:

Grand-mother + her 3 daughters + their 3 daughters($1 + 3 + 9 = 13$).

Inventive clerk case in Chapter 9

What he did was draw the data on calibrated 100 gram paper and then cut out the graph and weighed it.



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