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9

# Creative thinking

It is a well known fact that all inventors get their first ideas on the back of an envelope. I take a slight exception to this, I use the front so that I can incorporate the stamp and then the design is already half done.

Roland Emett

Genius is one per cent inspiration and ninety-nine per cent perspiration.

Thomas Alva Edison

## What do we mean by creativity?

Most people would describe design as one of the most creative of human pursuits. The so-called creative arts include musical composition, painting, sculpture and the various forms of two- and three-dimensional design. However, creativity and creative thought can be applied just as much in science, medicine, philosophy, the law, management and many other fields of human endeavour. In the creative arts, including design, the whole point of the business is to create something which other people will experience and which is in some way or other original and new. No book on the thinking processes involved in design could be complete without some examination of the fundamentals of creativity and creative thought.

There is now a huge body of literature on creativity which has been studied extensively not only by psychologists but by philosophers and, more recently, by cognitive scientists and computer scientists. Some of our most profound insights into creativity also come from some famous and outstandingly creative people who have described and reflected on the processes involved. Then there are those who write about how to enhance or increase our creativity offering us techniques to use either as individuals or in groups.

Margaret Boden (1990) has proposed that it is useful to distinguish between what she calls H-creativity and P-creativity. H-creativity is that which results in novel and fundamentally new ideas in the history of the world. Thus Einstein's discovery of relativity or the moment when Archimedes leapt from his bath shouting 'Eureka!', are both moments of H-creativity. P-creativity, whilst less glamorous is none the less important to us here. For Margaret Boden rightly points out that an idea which is fundamentally novel to the individual mind is still of great significance, even though it may not necessarily be new to the world. Actually, in design there are often many developments of great significance for which it is quite hard to be sure just who had the H-creative idea and when. History tends to credit such developments to individuals as if they worked in splendid isolation from their colleagues and other designers.

When Alec Issigonis turned the internal combustion engine sideways, compressed the engine compartment, removed the traditional boot and styled the famous Mini, he created more than just another design for a car. By combining a number of new ideas together, he made us look at the car differently. Suddenly a motor car could become almost a fashion accessory, an extension of our clothes that could also transport us around cities. This was surely one of the most creative moments in the history of the automobile. Hundreds, perhaps thousands, of cars have been designed, but only occasionally does a design 'break the mould'. Other designs may be interesting, attractive, even exciting, but only occasionally is a design truly innovative. When Mario Bellini designed the famous Golfball typewriter for Olivetti he enabled us to see fundamentally new possibilities. The design replaced the traditional moving carriage carrying the paper from side to side, and instead kept the paper still, except for its feed, and moved the printing head. The further revolutionary idea of putting all the characters on a ball-shaped device which could rotate enabled the user to replace it and thus change fonts.

Many other examples can be found through the history of design which are innovative and mould breaking, and they often become what are regarded as 'classics' of design having a kind of timeless quality (Forty 1986). What these designs have in common is not just that they brilliantly solved the problems posed, but they changed the world irrevocably. They are the one-way valves of design history equivalent to the great discoveries of science. Once you have the Mini, a whole series of small, highly manoeuvrable, mass-produced city cars are possible. Small is no longer poor, but chic, fashionable and clever. Once you have the Barcelona Pavilion





designed by Mies van der Rohe in 1929 a whole new generation of buildings become possible in which the relationship between walls, the means of supporting the roof and the spaces they define become changed in fundamental ways.

However, let us begin at the beginning, which is something that the creative mind may often not do, but on this occasion it seems necessary!

## Some accounts of the creative process

The mathematician Henri Poincaré (1924) reflected on his own considerable creative achievements in mathematical thought and has left us with some insights about the processes involved. Typically he describes a process divided into phases of quite different kinds of thought. First a period of initial investigation of the problem in hand, followed by a more relaxed period of apparent mental rest. Next, an idea for the solution appears almost unbidden by the thinker probably at the most unexpected time and in the most unlikely place. Finally the solution needs elaboration, verification and development. Thus Poincaré describes his work for his first memoir on a series of mathematical functions known as Fuchsian. He talks of working hard for two weeks to prove that such functions could exist. During this period he sat at his desk for at least one or two hours each day trying out combinations without any positive result. However, one evening he unusually drank black coffee and could not sleep and records that 'ideas rose in crowds' (Poincaré 1924). By morning he had established a class of Fuchsian functions which he could then write down. Needing to take his ideas further to understand the relationship between these functions and some others he had discovered, his work was interrupted by a trip away from home on a geological excursion. He records how the travel made him forget his work but that later on the trip he was about to board a bus when 'at the moment I put my foot on the step the idea came to me' (Poincaré 1924).

This 'eureka' moment, as it is often called, seems quite characteristic of great creative moments. We have all heard how Archimedes is supposed to have leapt out of his bath crying 'Eureka' having solved a problem he had been working on for some time. Others such as Helmhotz and Hadamard offer similar descriptions, with the latter claiming to have woken with solutions in mind that were not there before sleep. More well known are the accounts of the

famous chemist Friedrich von Kekule who discovered the ring structure of the benzene molecule while half asleep in front of the fire.

It is not just scientists and mathematicians who report the sudden unexpected emergence of ideas. Painters, poets and composers seem to have similar experiences. Mozart wrote in a letter: 'When I am, as it were, completely myself, entirely alone, and of good cheer – say travelling in a carriage, or walking after a good meal, or during the night when I cannot sleep; it is on such occasions that my ideas flow best and most abundantly.' The poet, Stephen Spender, talks of a 'stream of words passing through my mind' when half asleep. Famously Samuel Taylor Coleridge reported having the vision which led to the extraordinary images of Xanadu in Kubla Khan, after having taken opium. So it goes on.

We must, however, not get too carried away with the romantic notion of the creative leap into the unknown. Creative thinkers also characteristically work very hard. True the great geniuses seem to find life fairly easy, but for most of us ideas come only after considerable effort, and may then require much working out. It is generally recognised that although Mozart would write down music almost as he saw it in his mind's eye, Beethoven felt the need to work over his ideas time and time again. Musical scholars have expressed astonishment at the apparent clumsiness of some of Beethoven's first notes, but of course we are all astonished by what he eventually did with them.

Thus great ideas are unlikely to come to us without effort, simply sitting in the bath, getting buses or dozing in front of the fire is unlikely to be enough. This is what Thomas Edison means when he talks of the 'ninety-nine per cent perspiration' in the quotation at the start of this chapter. The general consensus is that we may identify up to five phases in the creative process (Fig. 9.1) which we will call 'first insight', 'preparation', 'incubation', 'illumination', and 'verification' (Kneller 1965).

The period of 'first insight' simply involves recognising that a problem or problems exist and making a commitment to solve them. Thus the problem situation is formulated and expressed either formally or informally in the mind. This period is normally quite short, but may last many years. In design situations, the problem is rarely clearly stated at the outset and this phase may require considerable effort. It is interesting that many experienced designers report the need for a clear problem to exist before they can work creatively. The architect/engineer Santiago Calatrava has produced some of the most imaginative and innovative structures of our time, but all in response to specific problems: 'It is the answer to a particular



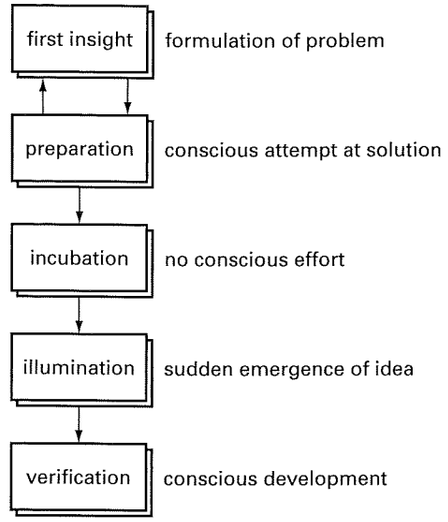


**Figure 9.1**
The popular five-stage model of the creative process



problem that makes the work of the engineer . . . I can no longer design just a pillar or an arch, you know I need a very precise problem, you need a place' (Lawson 1994a). A similar statement is attributed to Barnes Wallis: 'There has always been a problem first. I have never had a novel idea in my life. My achievements have been solutions to problems' (Whitfield 1975). Of course Barnes Wallis had many novel and innovative ideas, but he and Calatrava seem to be telling us that they are most creative when the problem is imposed upon them from outside. This might seem in conflict with some recently fashionable views on design education that students should be given free and open situations in order to develop their creativity!

The next phase of 'preparation' involves considerable conscious effort in the search for a solution to the problem. As we have seen, in design at least, there is likely to be some coming and going between this and the first phase as the problem may be reformulated or, even, completely redefined as the range of possible solutions is explored. What seems common ground amongst those who write about creativity, however, is that this period of intense, deliberate, hard work is frequently followed by the more relaxed period of 'incubation'.

We have already heard how Poincare's incubation came from a journey, but such a possibility does not always present itself to the practising designer. Alexander Moulton is famous for the innovative bicycle which carries his name and the rubber cone spring suspension system employed by Issigonis on the Mini which later gave rise to the Hydrolastic and eventually Hydragas systems. Moulton (Whitfield 1975) advises: 'I'm sure from a creative point of view that

it's important to have one or two dissimilar lines of thought to follow. Not too many, but just so that you can rest one groove in the mind and work in another.' Thus the practising designer and the design student alike need several things to work on in order not to waste time while one 'incubates'.

We have already documented the apparently magical moment of 'illumination' earlier in this chapter and little more needs to be said. Quite how and why the human mind works in this way is not certain. Some argue that during the incubation period the mind continues to reorganise and re-examine all the data which was absorbed during the intensive earlier periods. In a later chapter we shall examine some of the many techniques recommended for improving creativity. Most rely upon changing the direction of thinking, since it is generally recognised that we find it easier to go on in the same direction rather than start a new line of thought. The incubation period may also bring a line of thought to a stop, and when we return to the problem we find ourselves freer to go off in a new direction than we were before.

Finally we come to the period of 'verification' in which the idea is tested, elaborated and developed. Again, we must remind ourselves that in design, these phases are not as separate as this analysis suggests. Frequently the verification period will reveal the inadequacy of an idea, but the essence of it might still be valid. Perhaps this will lead to a reformulation of the problem and a new period of investigation, and so on.

## Speed of working

We can see from the previous section that the creative phases of the design process are likely to involve alternating periods of intense activity and more relaxed periods when little conscious mental effort is expended. This is characteristic of the descriptions we have from many good designers about their working methods. An excellent example of this comes again from Alexander Moulton:

> Thinking is a hard cerebral process. It mustn't be imagined that any of these problems are solved without a great deal of thought. You must drain yourself. The thing must be observed in the mind and turned over and over again in a three-dimensional sort of way. And when you have gone through this process you can let the computer in the mind, or whatever it is, chunter around while you pick up another problem.

Moulton also talks of a 'fury of speed so that the pressure of creativity is maintained and doubt held at bay'. Philippe Starck talks of





working intensively in order to 'capture the violence of the idea'. Starck famously claims to have designed a chair on an aircraft flight during the period of take-off while the seatbelt signs were on! In describing this intensive period of investigation a number of architects have likened it to juggling. Michael Wilford uses this analogy of a

> juggler who's got six balls in the air . . . and an architect is similarly operating on at least six fronts simultaneously and if you take your eye off one of them and drop it, you're in trouble'.
>
> (Lawson 1994a)

Richard MacCormac (Lawson 1994) echoes this idea and also points out that 'one couldn't juggle very slowly over a long period'. This explains the particular feature of being creative in design. It is rarely a simple problem with only one or two features, but more normally a whole host of criteria must be satisfied and a multitude of constraints respected. The only way to keep them all in mind at once, as it were, is to oscillate very quickly between them like a juggler. This of course may well not bring the solution immediately, as we have seen, that may come after a more relaxed incubation period.

## The creative personality?

Already in this chapter we have studied the words of a number of famously creative people who are scientists, mathematicians, composers, poets or, of course, designers. This raises the question as to whether or not some people are naturally more creative than others. Is creativity correlated with intelligence or are there some relationships between creativity and personality? Psychologists have studied highly creative people in the search for answers to these questions.

One study of exceptionally creative scientists (Roe 1952) found that they were characteristically very intelligent, but also persistent and highly motivated, self-sufficient, confident and assertive. Designers have been a popular subject group for such studies. Mackinnon has conducted a whole series of studies of the creative personality and he explains his choice of architects:

> It is in architects, of all our samples, that we can expect to find what is most generally characteristic of creative persons . . . in architecture, creative products are both an expression of the architect, and thus a very personal product, and at the same time an impersonal meeting of the demands of an external problem.
>
> (Mackinnon 1962)

He found his creative architects to be poised and confident, though not especially sociable. They were also characteristically intelligent, self-centred, outspoken and, even, aggressive and held a very high opinion of themselves (Mackinnon 1976). Disturbingly it was the group of architects judged as less creative who saw themselves as more responsible and having a greater sympathetic concern for others!

Intelligence does seem to play some part in creative talent. Mackinnon recorded that while 'no feeble-minded subjects have shown up in any of our creative groups', this does not mean that very intelligent people are naturally highly creative. The kinds of tests used by psychologists to measure creativity normally differ from the traditional intelligence test. The typical intelligence test question asks the subject to find a correct answer, usually through logical thought, whereas the creativity test question is more likely to have many acceptable answers.

Getzels and Jackson in a famous and rather controversial study, compared groups of children who scored highly on creativity tests with those who performed well at the more conventional intelligence tests. They claimed to have identified many differences between these two groups of gifted children, not least of which was the image the children had of themselves which was largely shared by their teachers (Getzels and Jackson 1962). The so-called 'intelligent' children were seen as conforming and compliant and tending to seek the approval of their elders, while the 'creative' children were more independent and tended to set their own standards. The so-called 'creative' children were less well liked by their teachers than the 'intelligent' children. This, together, with Mackinnon's descriptions of creative architects tends to confirm the often held view that highly creative people may not be easiest to get on with, and are not generally bothered by this.

More recently, the differences between the 'intelligent' and 'creative' groups has been seen as a tendency to excel in either convergent or divergent thinking. Hudson has conducted a whole series of studies of groups of schoolboys measured to have high performance at these two types of thinking skills. He has shown that, generally, high convergent ability schoolboys tend to be drawn to the sciences while their more divergent counterparts show a preference for the arts (Hudson 1966). In fact, science is no more a matter of purely convergent production than the arts are exclusively a matter of divergent thought (Hudson 1968). This concentration on convergent or divergent thought may therefore prove something of a red herring in developing our understanding of creativity.





This rather popular tendency to regard divergent thinking as the core skill in the arts does not stand up to examination. A visit to the Clore Gallery at the Tate in London will reveal just how persistent and single-minded was the great British painter J. M. W. Turner. Painting after painting reveals an obsession with the problem of portraying light on the solid canvas. There is no great flight of ideas here, but rather a lifetime of trying to perfect a technique. A glorious and wonderfully expressive technique.

Conversely, we have already seen how successful scientists may be regarded as highly creative and how their ideas generate a complete shift in the way we see things. A dramatic demonstration of this can be found in a most revealing account of the work of James Watson and Francis Crick who discovered the beautiful double helical geometry of DNA (Watson 1968). The structure of DNA as we know it today simply could not be logically deduced from the evidence available to Watson and Crick. They had to make a leap into the unknown, a demonstration of divergent thought *par excellence*!

## Creativity in design

Whilst we have seen that both convergent and divergent thought are needed by both scientists and artists, it is probably the designer who needs the two skills in the most equal proportions. Designers must solve externally imposed problems, satisfy the needs of others and create beautiful objects. Herman Hertzberger points this out when he describes what creativity means to him in architecture. He was discussing the problem of designing an entrance stair for a school:

> For me creativity is, you know, finding solutions for all these things that are contrary, and the wrong type of creativity is that you just forget about the fact that sometimes it rains, you forget that sometimes there are many people, and you just make beautiful stairs from the one idea you have in your head. This is not creativity, it is fake creativity.
>
> (Lawson 1994a)

These comments from Hertzberger suggests that we must be careful to draw the distinction between originality and creativity in design. In the competitive and sometimes rather commercial world of design, the novel and startlingly different can sometimes stand out and be acclaimed purely for that reason. But being creative in design is not purely or even necessarily a matter of being original.

The product designer Richard Seymour considers good design results from 'the unexpectedly relevant solution not wackiness parading as originality' (Lawson 1994a). The famous architect, Robert Venturi has said, for a designer, 'it is better to be good than to be original' (Lawson 1994a). Hertzberger, Seymour and Venturi all seem to be cautioning us against the recent trend to value the purely original-looking design without testing it to see if it really can fulfil the demands placed on it.

So we are beginning to get a picture of the creative process in design. It probably follows the phases of creativity outlined earlier, it involves periods of very intense, fast working rather like juggling, and the relating of many, often incompatible or at least conflicting demands. We have seen at the very beginning of this book how good design is often a matter of integration. George Sturt's cartwheels relied on the single idea of dishing to solve many totally different problems. This idea however is rarely easily found and often comes in a moment of 'illumination' after a long struggle.

It is hardly surprising then, that good designers tend to be at ease with the lack of resolution of their ideas for most of the design process. Things often only come together late on towards the end of the process. Those who prefer a more ordered and certain world may find themselves uncomfortable in the creative three-dimensional design fields. Characteristically designers seem to cope with this lack of resolution in two main ways: by the generation of alternatives and by using 'parallel lines of thought'.

Some designers seem to work deliberately to generate a series of alternative solutions early on, followed by a progressive refinement, testing and selection process. Others prefer to work on a single idea but accept that it may undergo revolution as well as evolution. Either way round, simply waiting for one idea to appear seems unlikely to prove very successful. It often seems to be the case that our thought processes have a will of their own. Once we have had an idea or started to look at a problem in a particular way it requires real effort to change direction. Creative thinkers in general and designers in particular seem to have the ability to change the direction of their thinking thus generating more ideas. We will discuss techniques for doing this as part of the design process in Chapter 12.

It is also clear that good designers characteristically have incomplete and possibly conflicting ideas as a matter of course, and allow these ideas to coexist without attempting to resolve them too early





in the process. These 'parallel lines of thought' will also be discussed in detail in Chapter 12.

## Education for creativity

In design at least, we have seen that there are a number of skills which experienced designers seem to have acquired that assist in releasing their creative potential. True, we have also seen that designers judged to be creative seem to share some common personality characteristics. The evidence is thus confusing, as it often is in psychology. Are we creative because we are born that way, or are we creative because we have learnt to be? We simply do not have a reliable answer to such a question, which in any case is not really the business of this book. Suffice it to say here that there is enough evidence that we can improve our creativity to warrant careful attention to the educational system through which designers pass.

In particular an issue here is the extent to which we should make design students aware of previous design work. One school of thought may suggest that students should be allowed a free and open-ended regime in which free expression is encouraged. Another might argue that designers have to solve real-world problems and they should pay attention to the acquisition of knowledge and experience.

Certainly there is much evidence on the side of the open, free and expressive school of thought. Many studies have, for example, demonstrated the mechanising effect of experience. Quite simply, once we have seen something done in a certain way, or done it ourselves, this experience tends to reinforce the idea in our minds and may block out other alternatives. In one of the most dramatic demonstrations of this phenomenon subjects were asked to perform simple arithmetic by pouring water between three jugs of different capacities. For each problem the actual size of the three jugs was varied, but for several problems in sequence the solution remained essentially the same. Later, a problem with an alternative and much simpler solution was presented, the subjects typically failed to notice and continued to use the more complex answer (Luchins and Luchins 1950).

An engineering lecturer once told me that he enjoyed teaching undergraduates because 'they didn't know certain things were difficult'. Consequently he found students occasionally came up with

novel solutions to problems which had already been thought to be well understood. Whilst he may have been right, what he failed to point out was that this was actually very rare, and much more normally his students suggested solutions which were already known not to work or be satisfactory. One tends to remember student successes rather than their failures!

By comparison Herman Hertzberger in his excellent book *Lessons for Students of Architecture* suggests the importance of gaining knowledge and experience:

> Everything that is absorbed and registered in your mind adds to the collection of ideas stored in the memory: a sort of library that you can consult whenever a problem arises. So, essentially the more you have seen, experienced and absorbed, the more points of reference you will have to help you decide which direction to take: your frame of reference expands.
> (Hertzberger 1991)

It remains the case, however, that design education all over the world is largely based on the studio where students learn by tackling problems rather than acquiring theory and then applying it. Learning from your own mistakes is usually more powerful than relying on gaining experience from others! The popularity and success of the studio system has more recently led some design educationalists to assume that all learning can be this way. There are, however, problems with such a system, for the student is not only learning through the studio project, but is also usually performing and being assessed through it. What might have made a good learning experience may not necessarily have generated a high mark. Unfortunately, too, the emphasis in such studios tends to be on the end product rather than the process. Thus students are expected to strive towards solutions which will be assessed, rather than showing a development in their methodology. Often, too, the inevitable 'crit' which ceremoniously concludes the studio project tends to focus on retrospective condemnation of elements of the end product rather than encouragement to develop better ways of working (Anthony 1991).

A study of design education in schools (Laxton 1969), concluded that children cannot expect to be truly creative without a reservoir of experience. Laxton developed a rather elegant model of design learning using the metaphor of a hydroelectric plant (Fig. 9.2). He argued for a three-stage model of design education in which major skills are identified and developed. The ability to initiate or express ideas, Laxton argued, is dependent on having a reservoir of knowledge from which to draw these ideas. This seems similar



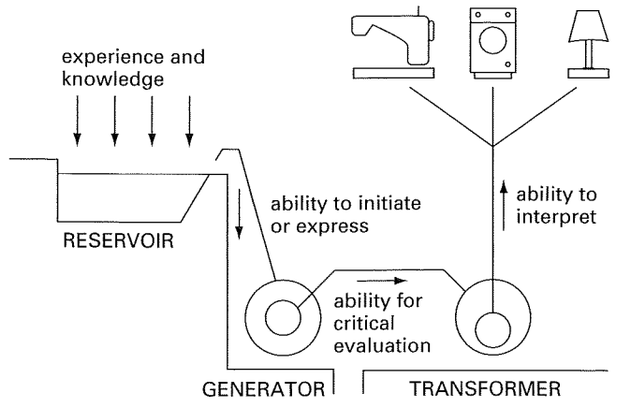


**Figure 9.2**
Laxton's ingenious hydro-electric model of design learning



to Hertzberger's exhortation to students of architecture to acquire knowledge. Laxton's second skill is the ability to evaluate and discriminate between ideas. Finally, the transformation or interpretative skill is needed to translate ideas into the appropriate and relevant context. Kneller (1965) in his study of creativity makes a similar point:

> One of the paradoxes of creativity is that, in order to think originally, we must familiarise ourselves with the ideas of others . . . These ideas can then form a springboard from which the creator's ideas can be launched.

Design education, then, is a delicate balance indeed between directing the student to acquire this knowledge and experience, and yet not mechanising his or her thought processes to the point of preventing the emergence of original ideas.

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10

# Guiding principles

Working in philosophy – like work in architecture – is really more a working on oneself.

Wittgenstein

'Why,' said the Dodo, 'the best way to explain it is to do it.'

Lewis Carroll, *Alice in Wonderland*

## Introduction

The designer does not approach each design problem afresh with a *tabula rasa*, or blank mind, as is implied by a considerable amount of the literature on design methods. Rather, designers have their own motivations, reasons for wanting to design, sets of beliefs, values and attitudes. In particular, designers usually develop quite strong sets of views about the way design in their field should be practised. This intellectual baggage is then brought by a designer into each project, sometimes very consciously and at other times rather less so. For some designers this collection of attitudes, beliefs and values are confused and ill formed, for others they are more clearly structured and for some they may even constitute something approaching a theory of design. Ultimately, some designers even go so far as to lay out these thoughts in books, articles or lectures. There is perhaps more of a tradition of publishing arguments and positions in some design fields than others. Architects, for example, seem more easily tempted to go into print than industrial designers! We might call these ideas 'design philosophies', although perhaps in many cases this would seem rather too grand a title. Whether they represent a collection of disjointed ideas, a coherent philosophy or even a complete theory of design, these ideas can be seen as a set of 'guiding principles'. This collection of principles is likely to grow and change as a designer develops. Sometimes they may be defended with