Metaphors of Memory

A HISTORY OF IDEAS ABOUT THE MIND

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A catalogue record for this book is available from the British Library

Library of Congress cataloguing in publication data

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1   The Mystic Writing-Pad

Whenever I distrust my memory, writes Freud in a note of 1925, I can resort to pen and paper.[1] Paper then becomes an external part of my memory and retains something which I would otherwise carry about with me invisibly. When I write on a sheet of paper, I am sure that I have an enduring 'remembrance', safe from the 'possible distortions to which it might have been subjected in my actual memory'.[2] The disadvantage is that I cannot undo my note when it is no longer needed and that the page becomes full. The writing surface is used up. Both shortcomings are absent in another method: slate and chalk. A slate can be constantly reused and hence has an unlimited capacity. But the disadvantage of the slate is that to jot down new notes you first have to rub out an old one. It therefore looks as though an unlimited capacity and enduring traces exclude each other among the aids that we use to replace our memory. Hence sheets of paper and slates lack precisely the quality that makes human memory so strangely efficient, says Freud, 'since our mental apparatus accomplishes precisely what they cannot: it has an unlimited receptive capacity for new perceptions and nevertheless lays down permanent, though not unalterable, memory-traces of them'.[3]

Subsequently Freud explains that as early as 1900 in *The Interpretation of Dreams*, he had voiced the suspicion that the unusual achievements of our psychical apparatus could be ascribed to the operation of two different systems. The first, the 'perception-consciousness', records perceptions without retaining a permanent trace of them. It is a *tabula rasa* in the face of every new experience. The second system, the 'mnemic system', lies behind the perceiving consciousness and retains the enduring traces of our perceptions. But how is one to imagine this combination of apparently incompatible functions?

Not so long ago, writes Freud, a device was put on the market under the name of *Wunderblock* or 'Mystic Writing-Pad'. It consists of a wax layer, covered by a sheet of wax paper and a transparent celluloid sheet. If one writes on the celluloid, one sees the text appear on the wax paper. If the text has to be erased one simply pulls the paper free of the wax layer and the Mystic Writing-Pad is

again blank. But if one looks under the wax paper, one sees that at a deeper level an enduring trace has been preserved, the wax is now engraved with what was previously only visible on the wax paper. The outer sheets are again blank, as though they had never been written on, while on the inner one everything has been preserved. The Mystic Writing-Pad, concludes Freud,

> solves the problem of combining the two functions *by dividing them between two separate but related component parts or systems*. But this is precisely the way in which, according to the hypothesis which I mentioned just now, our mental apparatus performs its perceptual function. The layer which receives the stimuli – the system Pcpt.-Cs – forms no permanent traces, the foundations of memory come about in other, adjoining, systems.[4] [The italics are Freud's]

In Freud's view the shortcomings of the Mystic Writing-Pad are not important for the analogy, what matters are the points of agreement. We need not be worried by the fact that the Mystic Writing-Pad cannot 'reproduce' the vanished script from inside, something that our memory *is* capable of. What counts is the parallel that goes even further than the simple combination of functions. In the case of the Mystic Writing-Pad the script disappears whenever the paper is separated from the wax layer. In the perceptual apparatus the interruption of the stream of innervation, the course of the neuronal impulses, has the same effect: without innervation the stimulus is not conducted to the deeper level and perception remains insensitive. Innervation corresponds to the contact between the paper and the wax layer in the Mystic Writing-Pad: 'If we imagine one hand writing on the surface of the Mystic Writing-Pad, while another periodically raises its covering sheet from the wax slab, we shall have a concrete representation of the way in which I tried to picture the functioning of the perceptual apparatus of our mind.'[5]

Freud was a master of imagery, an aspect of his work that has contributed greatly to his prestige as a writer.[6] But for Freud – who in 1930 was awarded the Goethe Prize for Literature – those metaphors had more than just a decorative function. In a letter to Ferenczi he defined scientific creativity as the interplay between 'daringly playful fantasy and relentlessly realistic criticism'.[7] In that alternation metaphors, comparisons and analogies were both inevitable and desirable: 'In psychology we can describe only with the help of comparisons. This is nothing special, it is the same elsewhere. But we are forced to change these comparisons over and over again, for none of them can serve us for any length of time.'[8]

Freud was true to his own theory. In his work there are scores of metaphors and analogies deriving from the most diverse fields.[9] Mythology provided metaphors for the articulation of the complexes named after Electra and Œdipus. Military science provided the metaphors for the relationship between the *ego*

and the unconscious. For example, Freud compared unconscious material which finds its way into the *ego* through a dream and there acts independently to an army of occupation which refuses to adapt to the laws of the land that it has invaded and promulgates new laws of its own. Sometimes the *ego* has to endure a siege by the *id* or psychoanalytic treatment is represented as a foreign intervention in a civil war. Other Freudian metaphors derive from physics and technology. The libido, for example, is a liquid which exercises a pressure and can overflow or drain away into a reservoir. There is a famous passage in which the *id* is compared to a pot full of seething excitement, a precarious balance of pressure and counter-pressure, fired up from below by urges and regulated from above by the compromises of the *ego*.[10] The second passion in Freud's life, archaeology, was also an inexhaustible source of metaphors. Just as an archaeologist tries to reconstruct the outlines and frescos of a vanished building from fragments of a wall and excavated shards, so the psychoanalyst has to draw his conclusions from his patients' fragments of memory and associations. When treating hysteria it was a case of working one's way layer by layer towards the trauma hidden beneath the hysteria. It was only when the traumatic memory had been thoroughly excavated and that erosion had taken hold of it that the symptoms could disappear. Wasn't it only after it had been excavated that the real destruction of Pompeii set in (figure 1)?

The metaphor must have been of great importance to Freud not only as a rhetorical instrument, but also as a heuristic aid in formulating a theory. What is the strange effectiveness of this tool based upon? A metaphor like that of the Mystic Writing-Pad is a 'verbal' phenomenon, but it also contains a reference to a concrete object and hence has a pictorial aspect. Like the Mystic Writing-Pad itself the metaphor is an instrument with two layers, a unification of word and image.

The metaphor as smoked glass. Three theories of metaphor

In the *Poetics* Aristotle defined the metaphor as 'the use of a strange name by the transfer from genus to species or from species to genus or from species to species or by comparison, that is: parallel'.[11] Present-day literary studies generally reserve the term metaphor for what Aristotle mentioned last, parallel, an analogous relationship between two objects, events or relationships. Aristotle's definition contains two terms which are still considered quintessential to metaphorical usage: the use of a 'strange name' and the 'transfer of meaning'. The first refers to the deviation from the usual context which can be pointed to in every metaphor. To give Aristotle's own example: the word 'evening' normally indicates a part of the day; therefore in the metaphor 'evening of one's life' the term 'evening' has become a 'strange name'. The concept of 'transfer' indicates that the connotations of the word in its usual context are transferred to the new, 'strange' context. That a river flows in one direction is an example of a

1.   A cabinet in Freud's consulting room, next to the door to his study. According to Freud himself he read more about archaeology in his lifetime than about psychology. He was a passionate collector of ancient artifacts. On tables and in glass cases, both in his consulting room and in his study, there was a huge display of vases, bowls and pots, sphinxes and Buddhas, reliefs, statuettes and busts. In May 1938, a few days before the Gestapo forced Freud to leave for London, Eduard Engelman took photographs of all Freud's rooms in the flat at Berggasse 19 in Vienna. One can see from these photographs that Freud treated patients and studied in rooms that were half-way between a library and a museum of antiquities.

connotation which in the metaphor 'time is a river' is transferred to a new context. This quality of metaphor is recorded in its etymology: the Greek verb 'metapherein' means 'to transport', or 'transfer'.

That metaphors take words out of their usual context and transfer their meaning to a new context is about the only thing on which there is a consensus in literary studies. Precisely what the relationship is between two contexts, how metaphors are related to reality or whether all metaphors can be exchanged for literal descriptions, even whether literal descriptions exist at all – there is a fundamental lack of consensus on all these matters. The fact that Freud's Mystic Writing-Pad is sometimes called a metaphor and sometimes an analogy or a model, reflects the conceptual conflicts in this part of the linguistic world.

In his *Philosophy of Rhetoric* of 1936, Richards opened up a debate on the epis-

temological status of metaphor which continues to the present day.[12] He also introduced a terminology for the analysis of metaphors which is still in use. According to Richards's analysis a metaphor is the formulation of a relationship between two terms. One is the 'topic term', the term about which the metaphor is asserting something, the other is the 'vehicle term', the term which transfers that meaning from another context, Aristotle's 'strange name'. In 'Memory is like a dog that lies down where it pleases', a metaphor of the Dutch writer Cees Nooteboom, 'memory' is the topic term and 'a dog that lies down where it pleases' the vehicle term.[13] For the similarity which is suggested by metaphor, in this case a memory which will not be ordered about, Richards uses the term 'tenor'.

Leading on from the ideas of Richards, Max Black has presented three interpretations or perspectives, in which metaphors are conceived of successively in terms of substitution, comparison and interaction.[14] In the 'substitution' interpretation, the vehicle term is an intruder in the sentence: it worms its way into the place of the literal term and makes the sentence, at first sight, incomprehensible. In 'Romario is a puma' the 'puma' turns the sentence about the Brazilian footballer, read literally, into nonsense. Only with the realisation that 'puma' is substituted for dreaminess, alternating with explosions of power, suppleness and speed, does the sentence acquire meaning. Metaphors are strictly speaking superfluous. If they are tolerated it is for decorative reasons; in principle they could be replaced by a literal expression.

The problem with the substitution interpretation is that many metaphors, particularly in science, owe their existence precisely to the fact that they express what cannot be said literally – either not yet or in principle. It is said of certain cells in the immune system that they 'recognise' pathogens: biochemists are working hard to discover the mechanisms which enable immune cells to do this, but those efforts have not so far resulted in a theory where the metaphor 'recognise' can be replaced by a literal description. In practice, and also in this case, progressive theory leads to an increase in metaphors: for example the specification of 'recognition' at the molecular level has led to a 'lock-and-key' mechanism. The metaphor 'recognise' is therefore not so much decorative or superfluous, at this moment there is simply no other choice.

For psychological metaphors the objections to the substitution interpretation weigh even more heavily. Whereas in the case of physical processes like the interaction between immune cells and pathogens one can form some kind of idea about a literal description, the literal description of *mental* processes seems to be fundamentally excluded. What is the literal equivalent of 'search processes' in the memory? How do you literally describe a process such as 'storing'? If 'filtering of information' is a metaphor, what literal description does it replace? The problem with much figurative usage in psychology is that no literal alternative is available.

An identical problem arises with the second theory of the relationship

between the terms of a metaphor: the metaphor as *comparison*. According to this interpretation a metaphor is the formulation of a similarity which the reader or listener must retrieve from the comparison between the metaphor's two terms. We know that time flows and we know that a river flows – in 'time is a river' flowing is therefore the parallel sought. In fact this view is a special case of substitution – Black also points this out – since it is assumed that the similarity between the two terms can be articulated in a literal description. For psychological metaphors this interpretation is as inadequate as that of substitution.

Black himself, following in the footsteps of Richards, argued for an interpretation of metaphor in terms of *interaction*. In a metaphor the topic term and vehicle term are linked by a set of associations and these associations are involved in an interaction. This reproduction creates a new meaning which is given neither in the one nor in the other term separately. In 'man is a wolf' for example, the associations of 'wolf' – cruel, treacherous, wild – are linked to the associations with 'man' and a new meaning of man as a wolf-like creature is created. Because this metaphor conversely gives the wolf something human, the interaction between both sets of associations are symmetrical, although in most metaphors the vehicle term will have a dominant influence. In the psychology of memory the computer metaphor is a convincing illustration of this interaction: the exchange of associations between computer and memory has not only made the memory more technical, but has made the computer more psychological.

Black has explained his position with the analogy of a visual filter. Anyone who looks up at the night sky through a piece of smoked glass with a few transparent strips across it, can see that the stars are in a straight line. In 'man is a wolf' the relevant associations of the vehicle term, cruel and wild, are the transparent parts, the irrelevant associations, hairy and fast moving, the black glass. In a formulation which evokes memories of the optical machinery of Athanasius Kircher, Black writes that in a metaphor the associations of one term are 'projected' over those of the other and so create a new pattern.

Although the filter analogy for metaphor has provoked quite a lot of criticism (rightly so: the dark glass may have an influence on what we see of the stars, but the stars change nothing about the glass), the interaction theory has been received enthusiastically. The idea that a metaphor creates a new meaning by eliminating some associations and accentuating others, links up with both older and more recent theories on the statics and dynamics of metaphors. So the core of the interaction theory had already been formulated by Richards in 1936: 'When we use a metaphor we have two thoughts active together and supported by a single word, or phrase, whose meaning is a resultant of their interaction.'[15] And this definition in its turn reminds us of the observation of Samuel Johnson that a metaphor 'gives you two ideas for one'. Present-day theorists like Martin and Harré write that the topic term and the vehicle term are each the centre of a 'semantic field' and that the interaction between these two fields enables us to produce and understand new insights.[16]

The interaction theory allows room for some marginal notes. The first is that the aspect of interaction will be more prominent the newer, more surprising and more original the metaphor is. Like all human creations metaphors are subject to wear and tear and the process of interaction between the two domains which is set in motion by a metaphor may become fainter and finally disappear. The phenomenon of the 'dead metaphor', the metaphor which has gradually become the literal expression, is the end result of this process. The metaphor 'go haywire', for example, derived from farming, has lost its graphic vitality as a description of human actions and has finally become ossified as a dead metaphor. (Ironically, such a metaphor has an amazing resurrection as soon as it is applied to a machine, as in 'the computer has gone haywire'.) Nietzsche compared the dead metaphor to a coin where the image of the head has worn away with use, a convincing analogy, because it is indeed the relief of the image which gradually becomes worn away and finally disappears completely from the expression. In this way the process of interaction also comes to a halt: the metaphor no longer gives 'two ideas for one' and has simply become a literal expression.

In the second place the interaction which is evoked by a metaphor will be more intense the more finely branched the networks of associations around both terms are. When both of the domains which are brought into contact in a metaphor are rich in associations, the mutual selection and organising of those associations will become all the more productive and it is more likely that the metaphor will produce new insights. Hooke's metaphor of the microcosm for the memory is – as will become apparent in a later chapter – an example of a metaphor in which the two terms were each linked with a detailed network of associations. In such a case a metaphor can have a considerable heuristic yield. The 'semantic fields' are in that case so fruitful that after the first harvest a second and a third may follow.

A third and final comment is that the interaction theory involves a move towards psychology. If the essence of metaphor is that associations from two domains come into interaction and that the product of that interaction is a new meaning, then that is a formulation in the categories of psychology. This poses the question of whether psychology is perhaps able to shed some light on the processes *behind* the use of metaphors. How does the interaction of associations operate? Exactly what processes are involved in the production and understanding of metaphors? What is the role of language, memory, or perception? What, in brief, has psychology to say about metaphors?

A brief psychology of metaphor

From the 1970s onwards psychological research into metaphors has grown rapidly. Important contributions have been made by such fields as linguistic and memory psychology. In developmental psychology, studies have been carried out into competence in the use of metaphors as a function of cognitive

maturation. In some respects theories of 'imagery' attach to theories about metaphors. The same applies to research into non-verbal processes in thought, reasoning and creativity. In educational psychology experimental studies have been carried out into the value of metaphors as didactic tools. A slightly unexpected approach is that of neuro-psychology: the production and interpreting of metaphors has, like all psychological processes, a substratum in brain processes and for the last decade and a half, neuro-psychological research has produced some interesting results in this area.

An intriguing quality of metaphors is that they are a union of opposites: they combine concrete and abstract, visual and verbal, graphic and conceptual. In a metaphor, writes Beck, there is a reference to a set of concrete relations in one situation, in order to facilitate the recognition of an analogous set of relations in another situation.[17] The essence of the metaphor is in her view the use of a concrete image in order to be able to understand or formulate abstract relations. She distinguishes two levels of thought. One is sensory and perceptual and consists of relatively diffuse categories. The ease with which we can understand synaesthetic use of language ('a warm colour', 'a sharp sound') underlines the fluid boundaries of verbal designations at this level. The second level is that of verbal and semantic thought. The designations here are more precise and more abstract. In Beck's view, the metaphor is an intermediary between these two agencies – it belongs neither completely to one nor to the other level, it mediates between analogous and semantic forms of thought. The metaphor is a *go-between*.

One can find some support for this interpretation of metaphor in recent attempts to map the neurological location of figurative language use.[18] It has so far not been possible to locate the 'neurological co-ordinates of metaphor', to quote Danesi, to the nearest degree, but there are some findings which illustrate that the metaphor, as a combination of image and language, is also a *go-between* from the neurological point of view. Most of those findings have been collected through research into hemispheric specialisation.

In 1940 a *split-brain* operation was carried out for the first time in a number of epileptic patients. This involves the left-hand and right-hand side of the cortex being surgically divided by partially severing the corpus callosum, a thick bundle of nerve fibres at the bottom of the brain. This type of surgery alleviates epileptic fits, and the reason for this is not because the fits remain limited to one side alone, as was first thought, but because the frequency of fits is reduced. A number of researchers, including the pioneer of neuro-psychological research with *split-brain* patients, Roger Sperry, have subsequently set up an experimental programme to determine a psychological profile of both halves of the brain. The results put an end to the old image of the relationship between the left and right hemispheres. The old image was that of an unequal marriage: a dominant hemisphere, usually the left-hand one, which contained all language functions, assisted by a subordinate hemisphere which kept quiet

and in which probably not much happened. The new view is that of equal partners, each with its own repertoire of specialisations. The left hemisphere has retained many of the language functions, such as the semantic, grammatical and phonological aspects of language. The verbal memory and abstract and analytical thought are also located on the left-hand side. The right hemisphere is associated with visual memory, spatial orientation and concrete and synthetic thought.[19] Various experiments suggest that this specialisation can also be identified in the processing of figurative language usage.

In a classic experiment Winner and Gardner presented their test subjects with a series of metaphors.[20] Each metaphor was linked with four pictures, from which the test subject had to choose the picture which best represented the meaning of the metaphor. Other pictures represented the literal meaning of the metaphor or the image used itself. In the case of the metaphor 'he was wearing a loud tie' the distracting images were a tie from which a noise came, an ordinary tie and a man who spoke loudly. The correct picture was a man with a brashly coloured tie. There were three groups of test subjects: aphasics (mostly patients with damage to the left hemisphere), patients with damage to the right hemisphere, and a control group of people without damage. Patients with brain damage to the left hemisphere as a rule chose the picture which corresponded with the meaning of the metaphor. But patients with damage to the right hemisphere chose the literal meaning as often as the figurative one, which suggests that they have difficulty in distinguishing the two types of meaning. In a similar study it emerged that patients with right-hemisphere damage have considerable problems in discovering and explaining the meaning of proverbs.[21] In view of the character of proverbs – a concrete image that has to be generalised into an abstract relationship – it is not surprising that interpreting proverbs can be disrupted by damage to the right hemisphere.

These results led to the cautious conclusion that in processing metaphors two different psychological processes are involved, each with its own neurological substratum. According to this view the correct interpretation of figurative language depends on the integration of a 'language-based' and an 'image-based' process. Right-hemisphere damage, it is argued, impairs the processing of visual 'image-based' aspects and hence the interpretation of the metaphor as a whole.

Through their combination of image and language, of graphic and abstract, metaphors are ideally suited to explaining and teaching theories. It would be appropriate to call this the 'Comenius function' of metaphors, after the seventeenth-century Bohemian philosopher and pedagogue Johannes Amos Comenius who in 1657 in his *Didactica Magna* was the first to argue at length in favour of graphic education. First of all one can observe that metaphors are indeed used widely for that purpose, in both specialist and non-specialist publications. Curtis and Reigeluth checked a series of text books in the field of the sciences for the use of metaphors and analogies.[22] Their findings were

sufficiently numerous to base a taxonomy on. In the case of a *structural* relationship the entities to which the topic and vehicle term refer have a similar structure, as in 'a cell is like a room, with a floor, a ceiling and walls'. In the case of a 'functional' relationship the two terms of the metaphor have their operation in common, as in 'feedback operates like a thermostat'. In most cases the topic term has an abstract character and the vehicle term refers to something concrete: 'The electrons in a grid behave like marbles on a drum skin.' In an analysis of articles in two Dutch popular scientific magazines, Woudstra found a total of 79 metaphors, predominantly of a functional kind (70%) in three issues of each magazine.[23] The proportion of functional metaphors increased as the context became more complicated. In all cases the vehicle term was concrete. In their much more extensive survey (26 books) Curtis and Reigeluth found a marked preponderance (82%) of metaphors in which the topic term was abstract and the vehicle term concrete.

The Comenius function of metaphors has been investigated experimentally as well as through the study of educational texts. Research by Reynolds and Schwartz suggests that metaphors contribute to the educational effectiveness of graphic presentation.[24] They presented their test subjects with eight short texts to be studied. Each text ended with a conclusion. In one condition the conclusion was phrased in a literal sentence, in the other condition, it was phrased in a metaphor. Reproduction of what had been read showed that metaphorically formulated conclusions had been retained better than literal conclusions. Moreover, test subjects in the case of the metaphor condition remembered more details from the preceding text. The authors think that metaphors enable one to set the process of reproduction in motion more easily and to pursue it for longer.

A finding such as this might be based on *dual coding*. On the basis of experimental and theoretical work, Paivio has suggested that in inventing and understanding metaphors two systems are involved which function autonomously, but can exchange information mutually.[25] One system is geared to linguistic information and makes use of verbal presentations which are processed sequentially. The other system processes information which relates to concrete objects and events and is represented in images which are in most cases visual in nature. Metaphors are the product of the co-operation between these two systems. Paivio specified various mechanisms which are intended to explain why the process of *dual coding* supports the communicative function of metaphors.

In the first place, the activity of two independent, but co-operating systems facilitates access to information in the long-term memory. If a metaphor activates *two* association processes, verbal and visual, it is more likely that the information will actually be found. Experiments have shown that the availability of non-verbal representations facilitates the reproduction of verbal material. Pictures are retained better than words, concrete words better than abstract

words, and instructions to combine two separate words into an image of one's own invention leads to an improvement in verbal reproduction. The dual coding which is induced by metaphors is in this view a cognitive investment which pays off in the reproduction phase.

In the second place, the *image* in the metaphor allows for an efficient storage of information. The vehicle term refers to a concrete, vivid graphic image, the characteristics of which are stored as an integrated package or 'chunk' and can also be reproduced again as a coherent whole. With an image we immediately have a set of relationships. Unlike sequentially processed verbal information, these relationships are a simultaneous given. In the third place, the vehicle term can function as a *conceptual peg* on which the more abstract terms can be hung. In an experiment by Verbrugge and McCarrell the test subjects were presented with a series of metaphors.[26] Later they were asked to reproduce these. In one condition the vehicle term, containing the 'image' of the metaphor, was presented and the test subjects were asked to reproduce the metaphor as a whole (the complete metaphor). In the second condition, the experimenters presented the topic term, the 'subject' of the metaphor, as a clue. Comparison showed that the vehicle term was a more efficient clue than the topic term. Obviously the concrete image is able to attach more information to itself. Metaphor enables the memory function to fish with several hooks at once.

The metaphor as a heuristic tool

The cognitive characteristics of metaphors which have just been discussed can also be found in the phase which historians of science usually call the *context of discovery*. Jerome Bruner derived the impression from observation of himself and his colleagues 'that the forging of metaphoric hunch into testable hypothesis goes on all the time', but that researchers always tried to give their publications in the professional press an 'aseptic quality', cleansed of metaphorical impurities.[27] He added that in that way one is removing one of the most fruitful sources of ideas from view. In the natural sciences it has been extensively documented how concrete and graphic events or objects have provided the inspiration for new technical notions or hypotheses. A few examples will have to suffice. In 1866, three years before Mendeleyev compiled his periodic system of elements, the English chemist Newlands presented a specification of elements by using the analogy of a piano keyboard.[28] Newlands grouped the elements in series of eight and compared those series to octaves, because each eighth element was a repetition of the first. He called this the law of the octaves in chemistry. Thus, by projecting the semantic field of ordering notes onto the ordering of chemical elements he anticipated Mendeleyev's system. In the history of immunology, too, hypotheses can be pointed to which owe their existence to concrete relations in a completely different domain. The Russian biologist Metchnikoff investigated the behaviour of cells in the transparent larvae of starfish. When, more or less by chance, some wood shavings found their way

into the vicinity of the larvae, he observed that the larvae wrapped themselves around the shavings and ingested them. This reminded him of the pus that forms when a splinter causes an infection, which in turn led to the discovery of the most important defence mechanism in the human immune system: the phagocytes (literally, 'eater cells'), white blood corpuscles which absorb and consume invading bacteria. One monograph on the history of immunology has the appropriate sub-title 'From Metaphor to Theory'.[29] Visual representations have also played a crucial role in the more theoretical parts of physics. It is known from his own statements that Einstein conceptualised his theory in the form of visual images which he manipulated in thought experiments.[30] For example, he imagined a journey on a ray of light. If he were to hold a mirror in front of him in such a situation, then he would not be able to see his own image in it, because light cannot go faster than the speed of light and hence cannot catch up with the mirror. Just like a vampire, writes Dreistadt, Einstein would look into an empty mirror and visualise the relativity of optical processes.[31] The representation in a concrete image which can be inspected and integrated as a whole in the case of Einstein preceded the conceptualisation in a formal theory.

The number of examples could easily be extended.[32] The invariable outcome is always that the relations in a semantic field which are accessible to the imagination are used to discover or make more precise relations in the research field. This form of heuristics can be divided into two types. *Theoretical* heuristics means that a metaphor introduces new theoretical notions, brings coherence to hypothetical processes or is able to resolve apparent contradictions between experimental results, while *empirical* heuristics describes the degree to which a metaphor produces new topics for research. Harvey's metaphor 'the heart is a pump' had powerful heuristic value in both theoretical and empirical respects. The pump metaphor provided theories on the operation of the heart with new concepts such as the '*circulation* of the blood', organised separate findings into a coherent representation and explained experimental results which in terms of an earlier metaphor – the movement of the blood seen as the movement of the tides – were an anomaly. The heuristic value of the pump metaphor was shown by experiments designed to answer questions such as: Does blood pressure relate to the distance from the pump? What is the speed of the circulation of the blood? Does restricting the flow in one channel increase the hydraulic pressure in other channels? These questions were all derived from associations related to the vehicle domain of the mechanical pump (figure 2).

But heuristics also has a downside. A meta-metaphor like 'filter' expresses the fact that metaphors make one part of the information more visible, but do so by eliminating the rest of the information. In the directing, filtering and selecting of attention there is the implication that the information which was originally present is reduced. This has negative effects in both theoretical and in empirical respects: theoretical notions which are not noticed, hypotheses which are neglected, relationships which are removed from view, research

2. This frontispiece to *Corporis humani disquisitio anatomica* (The Hague, 1651) by the English doctor Nathaniel Highmore, is an allegory on the empirical turn taken by anatomy. The goddess Anatomia is seated at the top in the centre on her throne. She has turned away from the bearded man on her left who is absorbed in philosophical reflection in a 'museum of contemplation', preferring to give her attention to the Theatrum Autopsiae on her right. Here scientists are busily engaged in research. On the table lies a cadaver, under the gaze of a double row of onlookers. The anatomist has removed the heart (a section of the aorta is still dangling from it) and he raises it in devotion to the goddess. The centre of the picture is reserved for an irrigation pump, as a metaphor of a heart, which ever since Harvey's *De motu cordis* (1628) had pumped and caused the blood to circulate and irrigate the tissues of the body. The pump is operated by a hand that appears from the clouds. Even if the heart had become a mechanical instrument, it was still kept in motion from above.

topics which are ignored. This disadvantage has over the centuries fed suspicion and disdain towards metaphor in philosophy and science. For John Locke, metaphor was 'an instrument of error and deceit'. Francis Bacon classified the metaphor under the *idola fori*, the heresies which are the result of confused language use. As we will see in chapter 3, in Royal Society circles the deprecation even took the form of an explicit ban on imagery in scientific publications.

Freud's recommendation to alternate metaphors as often as possible is an attempt to benefit from the advantages of metaphors, while eliminating their disadvantages: if each filter makes a different aspect visible, it is only from a combination of metaphors that the most complete image of reality can be expected. Unfortunately this advice is not so easy to follow in recent memory psychology. As will be extensively documented below modern metaphors for memory like the computer or the hologram are so all-embracing that it would be better to speak of metaphoric *themes* than metaphors. They not only furnish metaphorical terms for separate functions, they also provide a background against which all those separate metaphors have meaning. The interpretation of specific computational and holographic metaphors presupposes the metaphor theme of which they are part. In this situation metaphors cannot be freely interchanged and that creates a completely different metaphorical dynamic than that outlined by Freud.

Freud's description of memory as a Mystic Writing-Pad was no more than a note, an essay of a mere five or six pages, but like a scale model it summarises a lot of what has already been discussed about metaphors. The topic terms in the note all refer to abstractions, such as 'perceptual consciousness', and 'memory system'. The vehicle terms are derived from the concrete, graphic apparatus, the Mystic Writing-Pad. In this way Freud, as Black would put it, projected the associations of one domain onto those of the other domain and so obtained Samuel Johnson's 'two ideas for one'. The effect is that some associations are eliminated, others accentuated. The metaphor of the Mystic Writing-Pad therefore functions as a filter. In the taxonomy of Curtis and Reigeluth the Mystic Writing-Pad would fall under the functional metaphors: the presupposed relationships between the mental systems correspond in function and operation to the various components of the Mystic Writing-Pad. What Freud intended with his metaphor was on his own testimony mainly at the level of explanation and clarification, the Comenius function of metaphors. To this end he explains as graphically as possible how a Mystic Writing-Pad is constructed. According to the *dual coding* of Paivio, both verbal and pictorial information is presented in this way and so the functional relationship between the various sheets of the Mystic Writing-Pad can be stored in the memory as an integrated whole. The vehicle term of the metaphor can subsequently function as a *conceptual peg* when the information has to be reproduced.

But besides this didactic or educative function the metaphor of the Mystic Writing-Pad also seems to have played a role in the development of Freud's ideas

on the relationships within the 'mental apparatus'. He writes in the note that in *The Interpretation of Dreams* he had attributed the combination of a permanently available surface and a record of permanent traces to two different systems and that the existence of those two systems had been a 'hunch'. Once an artificial system was available that was actually able to unite both functions, Freud believed that this theory increased in plausibility. If one subjects the Mystic Writing-Pad to closer examination, he writes, 'it will be found that its construction shows a remarkable agreement with my hypothetical structure of our perceptual apparatus and that it can in fact provide both an ever-ready receptive surface and permanent traces of the notes that have been made upon it'.[33] The metaphor not only served to explain the theory: Freud also profited from the heuristic value of metaphor by linking a number of properties of the Mystic Writing-Pad with different qualities of the 'mental apparatus' *besides* the qualities which required clarification in the first instance. An example of this is the analogy between the erasure through the breaking of the contact between the paper sheet and the wax layer and the periodical interruption of innervation. It looks as though the combination of two different 'semantic fields' enables Freud to harvest more than what he was originally after. The metaphor of the Mystic Writing-Pad made his hypothesis more exact.

An appealing fantasy would be to transport Freud to the present day and ask ourselves what metaphor he would have used now in order to express the mysterious combination of permanent traces and an unlimited surface area for new notes. Possibly he would have turned to the Mystic Writing-Pad of our time, the computer, a quasi-'mental' device which can absorb, delete and reproduce information. In an analysis of Freud's comments on the 'mental apparatus', Erdelyi tried to group the metaphor of the Mystic Writing-Pad with more recent metaphors for the processing of information.[34] A simple programmable pocket calculator, Erdelyi argues, would be a better choice than the Mystic Writing-Pad. The information keyed in, which is visible in a window, can be stored, if required, in a back-up memory. That frees the window for the inclusion of new information, while the old information still remains available. In so doing, the calculator demonstrates the combination of functions which Freud pointed to as the essence of the Mystic Writing-Pad. Subsequently the calculator also has two functions which are lacking in the Mystic Writing-Pad. Writing, which once it has disappeared, as Freud pointed out himself, can no longer be reproduced by the Mystic Writing-Pad from within ('it would be a mystic pad indeed if, like our memory, it could accomplish that').[35] The calculator is able to do that. From the back-up memory the information can be brought back to the window. A second function which is lacking in the Mystic Writing-Pad is the possibility of changing permanent traces: what is written in the wax layer can be added to, not changed. The calculator does give us that option: the information in the back-up memory can be adapted at will, without first appearing again in the window.

But by turning the Mystic Writing-Pad into a 'pre-computer-information-processing-scheme' we are getting ahead of our story; the history of metaphors of memory begins with prosthetic memories considerably older than the Mystic Writing-Pad. The story should begin with the writing surface which in the days of Plato made the memory an instrument that absorbed impressions. This is the wax tablet.

Notes

1   S. Freud, 'A note upon the "mystic writing-pad"', in J. Strachey (ed.), *S. Freud, Collected Papers*, vol. v, New York, 1959, pp. 175–80. Originally published as 'Notiz über den "Wunderblock"', *Internationale Zeitschrift für ärztliche Psychoanalyse*, 11 (1925) 1, 1–5.

2   Freud, 'A note upon the "mystic writing-pad"', p. 175.

3   *Ibid.*, p. 176.

4   *Ibid.*, p. 179.

5   *Ibid.*, p. 180.

6   J. T. Edelson, 'Freud's use of metaphor', *Psychoanalytic Study of the Child*, 38 (1983), 17–59.

7   Quoted in D. E. Leary (ed.), *Metaphors in the History of Psychology*, Cambridge, MA, 1990, p. 43.

8   Quoted in B. Bettelheim, *Freud and Man's Soul*, New York, 1983, p. 37.

9   L. Breger, 'Some metaphorical types met with in psychoanalytic theory', *Psychoanalysis and Contemporary Thought*, 4 (1981), 107–40; H. Nash, 'Freud and metaphor', *Archives of General Psychiatry*, 7 (1962), 25–9.

10   G. H. E. Russelman, *Van James Watt tot Sigmund Freud. De opkomst van het stuwmodel van de zelfexpressie*, Deventer, 1983.

11   Aristotle, *Poetics*, 57b6.

12   I. A. Richards, *The Philosophy of Rhetoric*, Oxford, 1936.

13   Quoted from C. Nooteboom, *Rituals*, trans. Adrienne Dixon, Baton Rouge, Louisiana, 1983, p. 1. Strictly speaking, the figure of speech 'x is like y' is not a metaphor, but a simile.

14   M. Black, *Models and Metaphors*, Ithaca, 1962.

15   Richards, *Philosophy*, p. 93.

16   J. Martin and R. Harré, 'Metaphor in science', in D. S. Miall (ed.), *Metaphor: Problems and Perspectives*, Sussex, 1982, pp. 89–105.

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32 E. S. Ferguson, 'The mind's eye: nonverbal thought in technology', *Science*, 197 (1977) 827–36.

33 Freud, 'A note upon the "mystic writing-pad"', p. 177.

34 M. H. Erdelyi, *Psychoanalysis: Freud's Cognitive Psychology*, New York, 1985, pp. 197–244.

35 Freud, 'A note upon the "mystic writing-pad"', p. 179.