The Metaphors of Constructivism

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Two recent publications in a constructivist tradition, Gary Drescher's Made-Up Minds: A Constructivist Approach to Artificial Intelligence (1991) and Michael Chapman's Constructive Evolution: Origins and Development of Piaget's Thought (1988), have prompted me to ask the question not 'What is Constructivism?' but instead 'What are its Metaphors?'. The former is hard, an embattled ground of subsidiary questions of definition, tradition, and variant practice. The latter is interesting, first of all from a general standpoint: how do people who describe themselves as constructivists see themselves and what they do, and second, because of the importance of metaphor and imagery in general within the tradition. Imagery and representation seems to be both the surface and the heart of what constructivists write about.

Take for example the front-cover illustrations for each of these books. Drescher has a picture of a contemplative baby, dissolved into and permeated by geometric structures, text, and symbols of processes represented by boxes, brackets and circles connected by arrows. Chapman, similarly, has a picture of a baby (which looks as if it could be Piaget himself at an early age). Its head breaks out of the photograph frame, and is crowned by a complex set of mathematical symbols for differential equations, exponential functions and summed series. In both cases, symbolic representation is more than a reflection of mental life: they appear as its most definitive part. Chapman's title is constructed of Scrabble tiles, an image for the origin, development and structure of thought as an editable text. His recursive application of Piaget's theories to Piaget's thought depends on writing both as a mediating and a 'making' process. Drescher's term 'made up minds' conveys the overlapping senses of fiction, construction, and decisiveness which characterise quite neatly the fascination that the technology of representation has for psychology.

Constructivism's core idea is that the self is made up and determined by inner structures which the self itself (so to speak) is able to design, build and alter. Hence terms such as genetic epistemology, since this 'structure of knowing' grows out of structures which precede and shape it fundamentally. The architectural metaphor — that the self is constructed, or that the development of the learner is likened to that of a building which becomes recursively the builder — is closely associated with the genetic metaphor, providing a sense of both determinism and free-will. The emphasis on individual autonomy, power and control in the developmental process is a clear feature of the tradition, most notably for computer educators in Papert's work. This view of the subjective self's ability to determine its own growth and change frames a kind of inner society of mind, in which the builder and the built, the grown and the growing, the architects and the structures, are both divided and unified, to be held in some arbitrated balance. One of the clearest expressions of the constructivist social metaphor in
artificial intelligence circles has, of course, been Minsky’s *The Society of Mind:*

[Thought] is not based on any single or uniform kind of ‘logic’ but upon myriads of varied kinds of processes, scripts, stereotypes, critics and censors, analogies and metaphors. Some of these are acquired through the operation of our genes, others are learned from our environments, and yet others we construct for ourselves. But even there, inside our minds, nobody ever really learns alone, since every step employs so many things we’ve learned before, from language, family, friends — as well as from our former Selves [states of being]. Without each stage to teach the next, no person could construct anything so complex as a mind. (Minsky, 1987, p. 184)

The social metaphor can be turned inside out, from the inner world of the mind, to the outer world of interacting individuals. Well-known examples which cross the supposed boundaries between inner and outer cultures include Sherry Turkle’s *The Second Self* (1984), and her recent work with Papert on ‘epistemological pluralism’ and styles and voices in the computer culture (Turkle & Papert, 1990). In *Psychoanalysis and Artificial Intelligence: A New Alliance* (1988) Turkle writes about the power of ‘sustaining myths’ to guide research, theory and practice in education, in a social realm which appears structured by the images we use. Her theme applies to the reflective benefits of using computers in education, and to the social construction of individual minds. In this way constructivist educators, despite their affirmations of individual autonomy, are linked to another, more socialist tradition of psychological development in which the key figure is Vygotsky. Here, the inner growth of an individual’s mind is linked to social interaction mainly through language, representation and mimicry (see 1985).

Metaphors in this tradition are also architectural and genetic, and include such well-known example as Vygotsky’s ‘zone of proximal development’. These images creep across the individualistic-socialist divide, so to speak, and blend perhaps unconsciously, as in Bruner’s imagery of scaffolding (Wood et al., 1976) and of cultural forum (Bruner, 1988).

Constructivist themes of individualistic personal control in a tension with the defining circumstances of culture are exemplified in the publication of *Mindsstorms* in 1980. Its context, of course, is the sharp rise in availability of programmable personal computers:

Much of *Mindsstorms* is devoted to building up images of the role of the computer very different from current stereotypes. All of us, professionals as well as laymen, must consciously break the habits we bring to thinking about the computer. Computation is in its infancy. It is hard to think of the computer of the future without projecting onto it the properties and limitations of those we think we know today. And nowhere is this more true than in imagining how computers can enter the world of education. It is not true to say that the image of a child’s relationship with a computer I shall develop here goes far beyond what is common in today’s schools. My image does not go beyond: It goes in the opposite direction.

In many schools today, the phrase ‘computer-aided instruction’ means making the computer teach the child. One might say the computer is being used to program the child. In my vision, the child programs the computer and, in doing so, both acquires a sense of mastery over a piece of the most modern and powerful technology and establishes an intimate contact with some of the deepest ideas from science, from mathematics, and from the art of intellectual model building. (Papert, 1989, p. 5) (author’s emphasis).

This is a rhetorical effort, dealing in images whose intention is to persuade and to provoke social change primarily in, and through, its images and symbolic expressions. Images and more generally imagination have a priority far in excess of that granted to mere reflection. They are acknowledged as the important structure of activities and also of thinking. The spatial and concrete imagery of ‘going beyond’ or of ‘opposite direction’ exemplifies the fundamental nature of the change Papert purposed. His frame of reference is one in which change of image brings about, as well as reflects, a change of practice and of thinking. The figure of instruction as a programming practice asserts a textual quality of educational activity. Within this textual frame, teaching and learning are matters of constructing and changing written texts which contain and convey images and representations that have material power over our lives and minds. The phrase ‘the computer is being used to program the child’ both resists and asserts the possibility of a constitution of mind by the external process of communicating executable yet executable models, representations and images. The phrase ‘the child programs the computer’ places this possibility within reach of the child as author of its own inner and outer texts. It interposes one more step in the analogy of programming and learning; as child is to external program, so is child and external program to internal program.

To an extent which often leads us to take it for granted, this position can be read as merely the extension of the central metaphor of cognitive science, and of Papert’s desire and emblematic image of placing the child in the cognitive scientist’s role:

Cognitive science is informed by a central metaphor: the mind depends on the brain in the same way that the execution of a program of symbolic instructions depends upon a computer. (Johnson-Laird, 1988, p. i)

Cognitive science, however, characteristically does not simply provide models of mind. It goes one or two steps further, in arguing the power of models in mind, and in the case of the ubiquitous information-processing model, of models and physical symbolic systems as mind. It is in this sense that Minsky argued every thought it is to some degree a metaphor. The distinction between writing and thinking becomes blurred. It is this overlap that provides the context for Papert’s beliefs and concerns, especially for the power of cultural imagery over thought. Changing our image of the relationship of child to program affirms the power of cultural and of mental imagery. It cements an identification, which is nonetheless powerful and effective for being ‘only a metaphorical...
identity', of learning and the activity of writing and editing executable representations in an external medium. In this frame, programmable constructs (that is to say, texts) become the form or template of the control of behaviour, a power over material and mental things through their common medium.

This abstract-concrete connection is presented as, and in the physical imagery of 'intimate contact with some of the deepest ideas'. The learner is here brought face to face with an important epistemological condition for self-construction: the recognition that mind is built through images, as in the Laurel's The Art of Human-Computer Interface Design (Kay, 1990) in the importance to him of Marshall McLuhan's work, about the internalisation of a medium to constitute the receiver of a message. A similar connection of the concrete, personal and intimate is made with the formal and the abstract, through the possibility of the personal computer:

In the summer of 1968 I got hit on the head randomly but repeatedly by some really nifty work [...Wel could all have an inexpensive powerful notebook computer — I called it a 'personal computer' then, but I was thinking intimacy. Read McLuhan's Understanding Media [1964] and understood that the most important thing about any communications medium is that message receipt is really message recovery; anyone who wishes to receive a message embedded in a medium must first have internalised the medium so it can be 'subtracted' out to leave the message behind. When he said 'the medium is the message' he meant that you have to become the medium if you use it. That's pretty scary. It means that even though humans are the animals that shape tools, it is in the nature of tools and man that learning to use tools reshapes us. So the 'message' of the printed book is, first, its availability to individuals, hence, its potential detachment from extant social processes; second, the uniformity, even coldness of noniconic type, which detaches reading from the vividness of the now and the slavery of commonsense thought to propel them into a far more abstract realm in which ideas that don't have easy visualisations can be treated. [...Though much of what McLuhan wrote was obscure and arguable, the sum total to me was a shock that reverberates even now. The computer is a medium! I had always thought of it as a tool, perhaps a vehicle — a much weaker conception. What McLuhan was saying is that if the personal computer is a truly new medium then the very use of it would actually change the thought patterns of an entire civilisation. [...The personal computer] promised to surpass the book to bring about a new renaissance by going beyond static representations to dynamic simulations. What kind of a thinker would you become if you grew up with an active simulator connected, not just to one point of view, but to all points of view at the ages represented so they could be dynamically tried out and compared? I named the notebook-sized computer idea the Dynabook to capture McLuhan's metaphor in the silicon to come. (Kay, 1990, pp. 192-3) (my emphasis in the last paragraph)

Kay's image of the computer, as an executable plastic medium that connects the outer social world to an inner mental world, is thus also an image of mind. Software re-creates a decisive, embedded point of view which may be edited and compared with other points of view. It is as if we can enter one mind or another by virtue of a medium, which carries and communicates but which also becomes.

It is not what is in front of us that counts in our books, televisions and computers but what gets into our heads and why we want to learn it. Yet as Marshall H. McLuhan, the philosopher of communications, has pointed out, the form is much of what does get into our heads; we become what we behold. The form of the earlier of the carrier of information is not neutral; it both dictates the kind of information conveyed and affects thinking processes. (Kay, 1991, pp. 102-3)

It matters little whether one can prove the existence in an inner, mental world, of structures analogous to the objects of Lego-Logo. What does matter is the sustaining myth, in this case, that learning is (like) building something. Underlying this useful fiction, this 'powerful idea' in Papert's terminology, is something deeper to do with the notion of useful fictions themselves, of why and how abstract ideas can become concretely 'powerful'.

I believe that this underlying stratum of metaphor about metaphor and how it works has a great deal to do with two aspects of contemporary culture. The first is, of course, the presence of the computer. The second is a tradition of cultural analysis which has applied semiotics, or the science of signs, to human behaviour and inner 'cognitive make-up'. Taken together, we can read the presence of the computer as a cultural model, not necessarily of other things such as minds or mathematics, but of the way editable, write-able, and read-able signs and symbols give rise to behaviour as in the notion of software.

This image of imagery, so to speak, frames the central notion of the power of representations in and over people's minds as a kind of cultural and epistemological software. It is, in short, as cybernetic as it is textual.

Like many myths that are this deeply rooted, the cybernetic myth — that human communication is no more
than the cybernetic machinery of consciousness and can be described in mechanical terms — arises from an unnameable collision of images, a monstrous oxymoron that lacks a name. I call it the Myth of the Soft Machine, stealing William Burroughs’ term. In Burroughs’ wild mythography, humans are simply messages type onto the jelly of flesh by a biological typewriter he calls the ‘soft machine’, referring not only to that most cybernetic of biological concepts, the genetic code, but also to media and even language itself. He tells us to send the machine a self-dismantling feedback message in order to free ourselves from the dominion of The Word (communication) over our imaginations. This complex image embodies the essentially postmodern version of human vulnerability, freedom, and uncertainty wedded to mechanical hardness, determinism, and order: we find its reflection not only in a cybernetic fiction but at large in our culture. ... Furthermore, this image signifies an inner condition common to many of us who feel we are species of soft machines who embody two contrary instincts for freedom and determinism, for the inexpressible and the totally inscribable, for spontaneity confined by a grammar of motives. Texts — like the ones Burroughs has assembled — which embody this felt paradox about mechanisms and systems, or order, control, and language, are also soft machines and form the emergent subgenre of cybernetic fiction. (Porush, 1989, p. 380)

The cybernetic viewpoint is enshrined in the general constructivist image of the self as if it were an artefact, which the self in collaboration with itself and others is able to build out of representations in some soft editable medium ‘messages typed onto the jelly of flesh’ in the ‘soft machine’. This cybernetic representation affirms the central role of representations in building internal intellectual or cognitive structures. These buildings seem to be symbolic arrangements that are as editable as they are collective. Such metaphors convey a notion about metaphor itself. What appears to be simply the speaking of one thing in terms of something else becomes the structure and the essence of thought. As Minsky put it, metaphors are operative myths: [Metaphor is the] myth that there is a clear distinction between representations that are ‘realistic’ and those that are merely suggestive. In their book Metaphors We Live By, [Lakoff & Johnson, 1980] ... Mark Johnson and George Lakoff demonstrate that metaphor is no mere special device of literary expression but permeates virtually every aspect of human thought. (Minsky, 1987, p. 330)

[If we think of the structure of metaphor as in two parts — the representation and what is represented — then, in the context of constructivism, the relation of one to the other it appears to reflect the basic cybernetic idea that the behaviour of a system can be expressed and governed at a symbolic level: information, a new kind of cultural text to shape and reflect us.]

BIBLIOGRAPHY


