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# Designer Species: Human uniqueness and its educational implications

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## Introduction

The purpose of this paper is to build on work presented at the last year's D&T Association conference, subsequently published in the Association's Journal, and to further explore the implications of human uniqueness for children's education in design and technology.

The research that underpins this paper and the proposed model of human cognitive processes (Figure.2) is founded on:

- Classroom-based research into children's design drawings (1998-2003). Examples within the paper are taken from this work.
- Theoretical investigation into the nature of design and creativity, which has led to conference papers and journal articles (2001-2008).
- Interest in insights from cognitive archaeology and the centrality of design capability in human evolution (2007-on-going).

Combining insights from cognitive archaeology, design theory and classroom observations, this paper explains the implications of the three core capabilities identified in Figure.2 for the purpose and content of design and technology education. The difference between humans and other species has enabled the purposeful design and construction of a complex physical, social and cultural environment through which we mediate our relationships between each other and the found and made world. This difference impacts directly on the education of the young: not only must they be taught to do what others can already do, but they need to be equipped to be creative designers of their own lives, spaces and relationships both with and within the physical and social world.

## Evolution past, present and future

In order to consider what makes humans different from other species, including other primates, we need to look back to the beginnings of our past, to the separation of the hominids from the other primates. Somewhere between 100,000 and 40,000 years ago, people (*Homo sapiens*) began to think differently,

probably strongly linked to the rise of symbolic language capability (Haarman, 2006). There was a sudden explosion of capabilities centred on tool-making and symbolism. Instead of simple, functional tools such as choppers and spears, a complex of tools and artefacts became personalised and made from several components, frequently combining materials and techniques (flaked stone mounted in a wooden handle secured by resin-soaked twine) and, increasingly, some objects were decorated or carefully made from rare imported materials, as if for special purposes. The celebratory, symbolic world, which we recognise as the essence of the human social world, had emerged as an interaction between our psychology and biology on one axis, and our technology and our socio-cultural systems on the other (Figure.1).

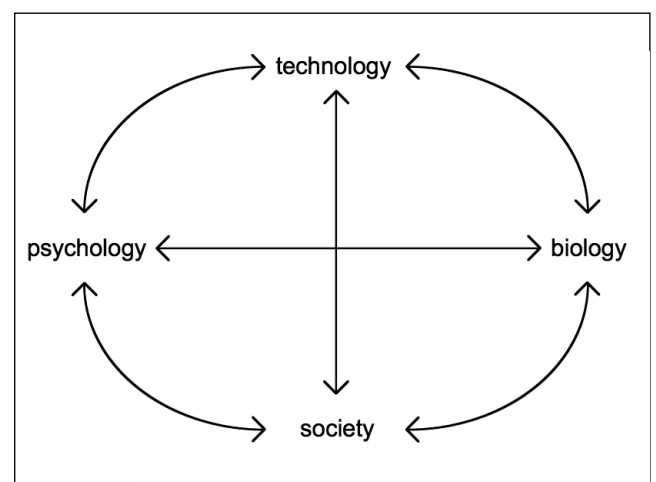


Figure 1: Symbolic world model

These characteristics are uniquely human. No other species, even within the primates, has ever taken tool-making into an agentic, symbolic, cultural world. In his discussion of the history of understanding technology, Layton (1993:26) takes Hughes' (1986:285) phraseology to speak of technology as "a seamless web of interactive components in a complex socio-technical system". He refers also to Pacey (1983:6) who identified three aspects to technology practice:

- Cultural: goals, values and ethical codes, beliefs in progress, awareness and creativity;
- Organisational: economic and industrial activity, professional activity, users and consumers, trade unions;
- Technical: knowledge, skills and techniques; tools, machines, chemicals, liveware; resources, products and wastes.

These apparently broad definitions of technological activity are, on closer examination, founded strongly on a Western industrial model of technological activity (Pacey's trade unions, for example). They are primarily systems models and Layton emphasises the importance of economic and organisational aspects. They are not models grounded in the physiology and psychology of humanity either historically or geographically, thus they are not of universal application to our whole species, nor do they recognise the intertwining of our technology with our evolution as a species, both cognitively and socio-culturally.

This is so much part of human make-up as to be largely taken for granted, if not ignored as if unworthy of study. Interest in the achievements of the great early civilisations on which Western civilisation is based (Babylon, Egypt, Greece and Rome) were traditionally focussed on mathematics, literature, philosophy and science, whereas interest in development of technology in antiquity was minimal before the 1960s (Schneider, 1992). The Society for the History of Technology was founded in 1958, whereas the publication of *Isis*, the leading journal of the history of science began in 1912 (Layton, 1993). The practical doing and making of ordinary everyday people, and even of those whose inventions changed the world (many of whose names are unknown) was so completely accepted as part of who we are that words such as "design" and "technology" were not in use before the industrial revolution in Europe changed the organisation of technological activity into factory-based mass-production systems dependent on wide resourcing and distribution networks.

Putting the two words "design" and "technology" together to make a unified subject "design and technology" to be taught in schools in England required, and continues to require, constant justification, yet these skills are at the heart of human survival and uniqueness. The recent reviews of the Primary school education in England (led by Sir Jim Rose and Professor Robin Alexander) have both sought to identify the most important features of education for young children, yet neither have taken on board the importance of designing and creating functional products. Not only is it important for young children to have practical hands-on skills (cutting, joining shaping of materials), but also to develop the cognitive modelling skills inherent within designing, together with the personal and social skills

involved in responding to needs, wants and opportunities for those designs and artefacts. These practical, cognitive, emotional and social skills are at the heart of what it is to be human, and every generation needs them.

## How the design mind works

Conceptual understandings of how the human mind works developed by cognitive theorists, epistemologists and cognitive archaeologists have large areas of theoretical overlap. These areas are ones that the design community recognises as essential to design capability. Thus, theoretical underpinnings that have currency within design research are to be found, not only among cognitive scientists and epistemologists, but also among the international community of cognitive archaeologists trying to identify those capabilities that separated humans from pre-humans in the evolution of our species.

For instance, epistemologist Gilbert Ryle argued for a distinction between *know-how* and *know-that* as forms of knowledge (Ryle, 1949). Recognition of both procedural and conceptual knowledge has its parallel in French archaeologist Pelegrin's (1991) "*savoir-faire*" (know-how; procedural knowledge) and "*connaissances*" (understanding; conceptual knowledge) that he attributed to the earliest human species who made symmetrical stone hand-axes.

The interaction between ideas in the mind's eye and their realisation in the material artefacts that we make (Kimbell, *et al.*, 1991) can be seen paralleled in:

- Winnicott's (1971) identification of the inner and outer realities of creative play among young children that fuels the development of the imagination;
- Foucault's (1969) distinction between :  
*Conscience-connaissance-science* (consciousness-conceptual understanding-science)  
*Discursive-savoir-science* (descriptive-factual knowledge-science).

Foucault (1969:247)

This distinction forms part of his discussion of the way in which society frames the categories by which phenomena are described and the interaction between internalised conceptual categories and the external observable world. The book is entitled "*L'archaéologie du Savoir*" (The Archaeology of Knowledge);

- Leroi-Gourhan (1973: 396-7) recognises both the inner (cognitive) and outer (environmental) milieu in the evolutionary development of material culture. Using evidence from both prehistory and ethnography, Leroi-Gourhan distinguishes human practical action from that of other creatures by its purposeful inventiveness:

"Pushing this further, it is apparent that the interior milieu produces artefacts, not in an automatic fashion, by a stereotypical reflex, but by successive intentions, which translate themselves in objects increasingly perfected, in progressive inventions."

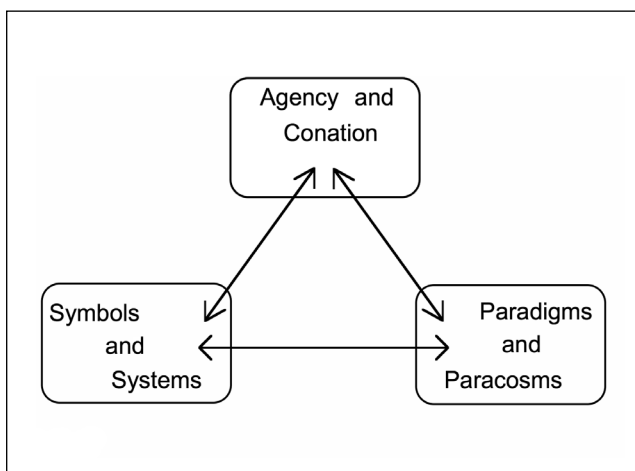
(Leroi-Gourhan (1975:397),  
personal translation, of original French).

These insights from psychology, philosophy and cognitive archaeology all have parallels in design theory, and can be observed among children in classrooms involved in design and technology activities. In a paper presented at the 2008 Design and Technology Association Conference, a tentative taxonomy of the cognitive skills of designing was presented (Hope, 2008). Since then, thoughts have crystallised and moved on, leading to the development of the triangulating model (Figure.2) that identifies three main areas which appear to underpin human design capabilities and which, by implication, should form the underpinning of design and technology education.

### Unpacking the psychology

There seems to be three main areas of human cognition that distinguish us from all other species and which underlie our design capabilities. These are shown in Figure.2.

*NOTE: In both models (Figures.1 & 2), the areas of human functioning are not seen as discrete entities but as inter-related and interacting capacities from which a complex web of relationships with the self, others and the world can be constructed and negotiated, within the overall context of the physical, mental, social and cultural environment in which people live and within which designing happens.*



**Figure 2: Three main areas which appear to underpin human design capabilities**

### Agency and Conation

Agency underlies human consciousness and also distinguishes human consciousness from that of other species:

"the capacity to exercise control over the nature and quality of one's life is the essence of humanness... the temporal extension of agency through intentionality and forethought, self-regulation by self-reactive influence, and self-reflectiveness about one's capabilities, quality of functioning, and the meaning and purpose of one's life pursuits."

(Bandura, 2001:1).

Being agentic involves the awareness of one's own Self as a free agent with choices and potentiality that leads to the awareness of others as agentic equals (other Selves), which in turn enables the capacity to empathise and take the perspective of others. The ability to consider the needs of others triggers the capacity to design artefacts and systems for which the designer may have no personal use. Children are expected to be able to do this at quite a young age. For instance, in an Early Years classroom, five-year-old children may be asked to design a boat for a story character to cross a river and escape from a dragon. This assumes the possession of a unique theory of mind that matures from infancy through to adulthood.

Figure. 3 shows 9-11 year olds' designs for glasses and coasters for their fruit cocktails. Not only have the children taken on board the practical needs (stability, water-tight, and so on) but have also personalised the sets. Each group was given a specific brief (for example: a vegetarian football fan from London) for whom their fruit cocktail and its cup and coaster would be appealing as well as appropriate. Seeing oneself as agentic provides the personal confidence to evaluate ideas, possibilities, actions and products, whether created by oneself or others.

The motivation that changes an idea in the head into a plan for action, the "will to do" is conation, which Atman (1992) sees as "goal orientation", the motivation that precipitates action, combining the needs of the moment with the cognisance of the final purpose and intended outcome of the activity. Combined with agency, this provides the impetus to improve on previous designs, to innovate and invent new artefacts, systems and environments. Agentic conation implies seeing oneself as able to act purposefully to effect changes in the social and physical environment – and also to do so. One of the major aims of design and technology education in the England has been for children to be equipped to



Figure 3: Children's designs for glasses and coasters

"think and intervene creatively to improve quality of life. The subject calls for pupils to become creative and autonomous problem-solvers, as individuals and members of a team."

(DfEE/QCA, 1999:15)

### Symbols and Systems

Other primates besides humans can respond to signs, gestures and symbols but they do not creatively combine symbols into systems that they can then manipulate as if these created systems were themselves symbols. Humans have the unique ability to devise symbolic systems as tools for generating, supporting, modelling and developing thought, through language, graphics, music, mathematics, electronic media and so on. All of these provide external memory capacity, making thought visible and enabling analysis of ideas and making possible the synthesis of novelty with tradition. The key skill, probably, is the ability to model ideas through symbolic systems; to be able to see the system as if it were the real object. For instance, a design drawing can be generated and discussed as if it were the real object: "What you could do is..." said Carl, aged 7, prodding his friend Nathan's drawing with his pencil.

As with agency and conation, the human ability to create and manipulate symbolic systems is evident from the earliest years of life, growing in complexity and scope, and it is foundational to the capability to design technological solutions to human needs and wants.

Figure.4 shows one child's evaluation of the cocktail designed and made by members of another group, illustrated in Figure.3. A mathematical graphic system has been used to plot and represent the ratings of each criterion against which the children were asked to judge the success of the cocktail. The children have needed to understand that:

- Preferences can be rated on a sliding scale between 1 and 5.
- These can be represented as a position on a line.

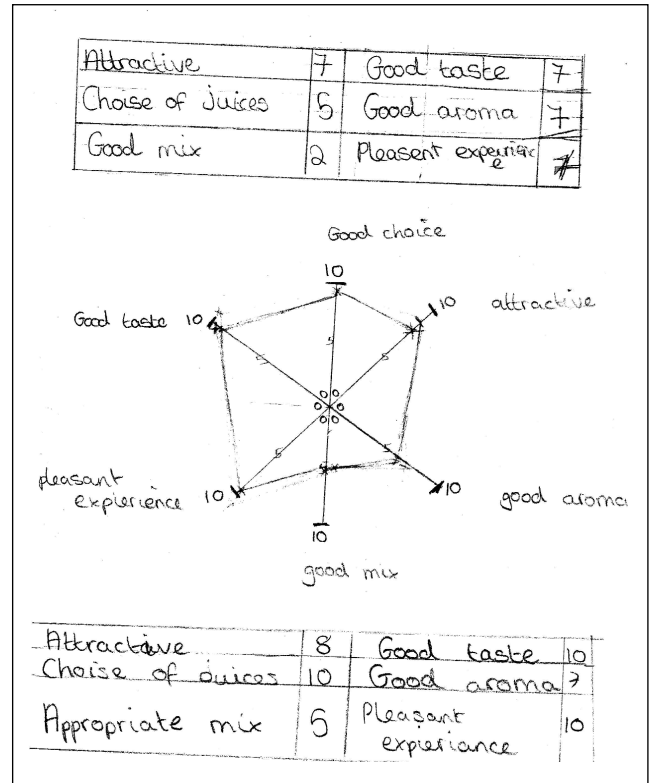


Figure 4: Child's evaluation

- Several of these lines, each representing a criterion, can provide an overall rating for the drink.
- These criteria lines can be organised as if they were spokes of a wheel to create a graphical representation of the overall rating of the drink on all criteria.
- Looking at the shape of the graphic will give an overall sense of the success of the design across all criteria.

This level of systematic abstract symbolism was taken in their stride by most of these 9-11 year old children.

### Paradigms and Paracosms

Paradigmatic thought is the system of induction and deduction that underpins the sciences (as, Kuhn 1970), whereas paracosmic thought is the capacity to create fantasies and coherent narratives. It has been claimed that the sciences and the arts do not mix (Snow 1959) and that narrative "truth-likeness" and paradigmatic "truth" are incompatible (Bruner, 1985). Polanyi (1958) asserted that the tacit knowledge underpinning each area of human knowledge severely limits communication across subject disciplines (he cites clashes between science and religion as exemplifying this).

However, designers use knowledge, insights and understandings from multiple fields of human endeavour and the combination of modes of thought enables the generation



**Figure 5: Working model of a ferris wheel**

of innovative design ideas that work. The marrying of aesthetics with hard science is fundamental to creating technological products that sell. Designers do not simply unite paradigmatic and paracosmic thought processes, it is their interaction that frequently creates the essential tensions out of which good, working designs come. Figure.5 shows a working model of a Ferris wheel, by the same class of 9-11 year olds, combining:

- the science of forces and motion;
  - with the technology of cams and gears;
  - with the needs of imaginary riders;
  - with the aesthetics of the fairground;
  - and, of course, what is possible with card, dowel, lolly sticks, cotton reels and paint.

Enabling children to move seamlessly from one mode of thought to the other is an essential part of design education. One of the problems of finding a “home” for design and technology within the new model for Primary education in England is that it fits with everything. The split between the arts and science that the new model implies could become problematic; design and technology requires the skills, understandings and capabilities of ways of seeing the world.

### **Drawings conclusions/putting it all together:**

Papanak (2000) began the first chapter of his book “design for the Real World” with the following words:

“All men are designers. All that we do, almost all the time, is design, for design is basic to all human activity. The planning and patterning of any act towards a desired, foreseeable end constitutes the design process. Any attempt to separate design, to make it a thing-by-itself, works counter to the inherent value of design as the primary, underlying matrix of life.”

Papanak (2000:3)

The final chapter of the book (“Design for Survival and Survival Through Design”) begins: “*Again: design is basic to...*” and he repeats the whole of the statement quoted above.

Figure.1 provided a model for the way in which our innate selves (our psychology and biology) interact with our overt selves (technology and society), whereas Figure.2 provided a model of how the psychology may be structured in order to support the process of designing. It was, I believe, the interaction and mutual reinforcement of the three elements of human cognition (Figure.2), within the inner-outer contexts of Figure.1, that became the driver for our evolution. Design and technology education has a key role to play in children’s education, not just because of its all-embracing and generic nature, but also because it is keying into all these elements of human uniqueness.

The work of cognitive archaeologists (Renfrew, Zubrow and international colleagues) suggests that the deciding factor that enabled humanity to populate the planet and survive and thrive was our ability to continually design new solutions to new challenges and to generate new ideas in response to new opportunities. In the contemporary world, design and technology educators are at the forefront of the challenge to educate those who will find the solutions to the technological needs and environmental problems that will beset the next generations. One of the external factors which the archaeologists claim drove human evolution was rapid climate change. Getting design and technology education right for the next generation or two might, therefore, be crucial.

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