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The Evolution of Technicity: Whence Creativity and Innovation?

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Abstract

This paper introduces the concept of 'technicity', a term borrowed from philosophy but recast in an Darwinian mould. Firstly, however, the presumption that language is THE unique and pre-eminent human trait is put to the adaptationist test. Evidence from palaeontology, primate studies and evolutionary psychology is brought together to (tentatively) suggest that language (speech) has a deep evolutionary past and that all members of the genus *Homo* possessed speech in some form. The second section marshals evidence that suggests our species possesses a new 'making things' adaptation. This adaptation appears to be the basis for the speciation event that defines behaviourally modern humans: our species. This is the capability for which the term 'technicity' is appropriated. The argument for splitting off language from technicity uses the concept of the extended phenotype. Technicity might best be characterised by a creative capacity to:

- a) deconstruct and reconstruct nature, and
- b) communicate by drawing.

The notion is floated that the newly evolved adaptation discretely insinuated itself into extant human culture; followed by brief consideration of the role of drawing, in the form of writing, on the precision and power of linguistic expression. It is suggested that technicity might usefully be considered the source of our intellect and language its whetstone. If further studies support the technicity hypothesis then reappraisal of conceptual framework underpinning the educational curriculum might be of benefit: a technology of language rather than the language of technology.

Key words: technicity, evolution, language, drawing, intellect, creativity.

Definition

Let me start by defining technicity. The French use it for a character of a product or person, a Gallic hi-tech with quality, precision, professionalism. My usage is based on the translation by Hubert Dreyfus (2002) of Martin Heidegger's *der Technik* (Krell 1993:Ch VII), whence: 'technicity', the attempt of modern man to dominate the earth by controlling beings that are considered as objects (Encyclopaedia Britannica 2000).

Introduction

I make no apology for borrowing a term from philosophy and bending it to my purpose. Design and technology, unlike traditional academic fields, seems to lack an intellectual core: it's all about making things. For rather longer than I care to think, this has concerned me. Our technical capability has transformed our planet and ourselves, and continues to do so. On an evolutionary timescale these changes have happened instantaneously. Developed over the past two decades, the field now called 'evolutionary psychology,' offers interesting insights into how we came to be. Unfortunately, neither this new field (Barrett et al: 2002), nor its academic precursors (such as Eysenck: 2000), has anything to say about how we are able make things. Look up how we perceive the world, and there is a plethora of research findings. Ask how we draw, say, a triangle and there is silence. At most we have a chronology of drawing development in children (Cox:1992). In this paper I hope to do two things:

- 1) Tease out and clarify 'language' as an evolutionary adaptation.
- 2) Draw out the core of modern human behaviour: our ability to create and innovate.

Thereafter I open a discussion of the technicity/language question. My apologies for the paucity of reference here, but as Dunbar (2003) confirms, these library shelves are rather bare.

Language

A biological adaptation for spoken communication

The accepted view

In education, English is the Queen of subjects. The National Curriculum, heralded by Kingman (DES:1988) and now enshrined in *Handbook 2000* (DfEE/QCA:1999), places English at its head and heart. Philosophers assert that descriptive and discursive language is unique to our species, and agree that it is our very highest cognitive capability: Philosopher Dennett (1996:171): we are the most intelligent of all species, 'We are also the only species with language'; Linguist Pinker (2003:207): it is our pre-eminent, awe-inspiring trait; Biologist Diamond (1992:125): without language we could not have built Chartres Cathedral; Science writer Tudge (1995:2): the ability to pool our thoughts through speech puts us qualitatively into a different league from all other species. Dawkins' (1989:Ch11, Blackmore 2000) 'meme' embodies this accepted



view. Jones (1994) writes of the 'language of genes'. Computerists have programming language, and Logo Turtle Talk (Papert 1980:Ch4). Language is pervasive and powerful, see Chang (1993:295) on the rhetoric of Mao. But in what manner was it a successful evolutionary adaptation?

An evolutionary chronology

Chomsky (cited Pinker 1994:389) rejected the idea that 'such systems as language' might be a product of natural selection. However, complexity and power are no counterarguments to natural selection: the eye is the standard refutation. Unlike tools and teeth, speech leaves no archaeological record. Hence chronologies vary. There is a view, supported by linguistic and genetic analysis (Cavalli-Sforza: 2001), that speech emerged when we did as a species some 100Ka years ago. Deacon (1998), however, argues persuasively for the co-evolution of language and the human brain over the whole 5Ma of hominine evolution. Dunbar (Barrett et al: 2002) opts for language, in the modern sense, being established half a million years ago concurrently with the appearance of anatomically modern humans. So, the answer to 'When?' appears to be: 'Before us.' But for what is language a successful adaptation?

The character of the adaptation

Primate studies, from Goodall (1986) to the present (Boesh et al: 2002) complement the data from palaeontology. Goodall's (1986) observation that much human behaviour, from cultural tool use to tribal warfare; from display to alliance forming; from gender grouping to consortship mirrors that of chimpanzees, is increasingly confirmed. The controversy (Pinker 1995; Jahme 2001) over ape, bonobo in particular, language-capability misses the point: primates have complex social communication skills. Dunbar (1996) proposed that language is an organ of social cohesion that evolved from behaviour similar to chimpanzee grooming.

Dunbar's hypothesis is rooted in the observation that humans are a uniquely cooperative species, which poses a significant problem in evolutionary theory. A given of genetics, (Dawkins 1989, 1988) is that altruism is only adaptive if sacrifice benefits genes held in common, i.e. by close kin. The reason for this rule is that within a population of co-operators who mutually reciprocate, a freerider, non-reciprocator, will gain more resources and thereby reproductive advantage. A population of co-operators is rapidly driven to extinction after the introduction of a few freeriders. If, however, you allow the co-operators a memory, so they can recall who scratched their back and who didn't, a tit-for-tat algorithm enables the co-operators to prosper and the system settles down into an

evolutionary stable state. The stable state is a mix of co-operators and freeriders. Evolutionary psychology (Barkow et al 1992; Pinker 1999; Evans & Zarate 1999) gives us a good idea of how and why cooperation is adaptive and of the evolution of defences against freeriders. The key organ for both is language (speech) and a good memory: and there appears to have been an evolutionary arms race. Dunbar correlated this with increased encephalization, cf. Deacon's (1998) co-evolution hypothesis. But Dunbar associates language with gossip, not intelligence. The co-operator/freerider warfare that drove the speech adaptation also includes sexual selection and competition and the provisioning requirements of females with increasingly immature, large brained neonates. Our 'theory of mind' (intentionality), devastatingly absent in autistic people, makes discursive conversation possible: 'I think that she thinks that he thinks that I think, etc.'. Description requires shared memories, as the grammatically and semantically correct but pragmatically defective speech of Williams syndrome sufferers demonstrates. One very telling characteristic of speech (language) is the correlation of linguistic diversity with natural resources (Nettle 1999). Diamond (1998) describes how a single language diverged into 600 mutually incomprehensible languages in New Guinea. Such instability of sound and grammar appears to be an unnecessary cost, so what might be the adaptive advantage? The co-operator/freerider conflict that besets our species provides an explanation. Evolutionary adaptation has built mechanisms into language both for freerider detection and community cohesion: phonetic drift is quite systematic and the sound system in static societies (accent) changes within as little as fifteen kilometres. Likewise vocabulary (dialect): the slang of gangs, specialist terms, and intergenerational shift serves a similar function. Freerider/co-operator conflict is sufficient, in my view, to account for the grammatical and semantic complexity of language. Speech is a biological adaptation that enables humans with memories-in-common to gossip.

Phenotype relationship

Clarity about the relationship of language to the human phenotype is important. Spoken, or gestural, language has no need of external aid. The memory is in the mind and speech and hearing are biological functions. Language is an organ, like the eye. There is nothing in the character or evolutionary trajectory of language that can lead to the conclusion that language per se is the cause of our ability to dress or make a scooter for the child, or build Chartres Cathedral, or create at all.



Technicity

The process by which modern man controls things by considering them as objects

Tool making and the extended phenotype

We have confused ourselves considerably by presuming that tools made and used by animals, from chimpanzee termite sticks to *H erectus*' finely crafted bifacial 'handaxes', are tools in the modern sense. Dawkins (1999) concept of the 'extended phenotype' is helpful in clarifying matters: certain animal tool-oriented behaviours are an external extension of the organism. Sticklebacks and birds' nests fit this category. The extended phenotype is a genetically determined species-specific pattern. The handaxe of *H erectus* fits the criterion. Unlike learned behaviour, such as chimpanzee nut cracking, no cultural transmission is involved, only the conditions for emergence.

The emergence of technicity

No species, present or past, *Homo* or otherwise, other than ourselves is creative or innovative. In Europe some 50Ka ago, the Neanderthals co-existed with the Cro-Magnons; the former anatomically modern humans, the latter behaviourally moderns (Leakey 1994; Lewin 1998). In their period of European co-existence Neanderthals picked up some Cro-Magnon innovations, no doubt by cultural transmission, possibly involving speech. Elsewhere, the Neanderthal stone tool assemblage, like that of *H erectus* and *H habilis*, remained essentially unchanged for 300 millennia. That is, the Neanderthals, with brains 150ml larger than ours, were uncreative. Hence, language alone appears insufficient – although the neurological information storage systems underpinning speech might be necessary – for the development of creativity.

We know little of the evolutionary trajectory of technicity, but a recent review by McBrearty and Brooks (2000) traces hesitant beginnings for technology back to about a half a million years ago. Within the varied species *Homo* in Africa around this time there were some who produced geometric stone flakes, which suggests component-built tools; and used ochre to colour artefacts. These peoples appeared to have coexisted, and waxed and waned, with other anatomically modern humans until, around 120Ka ago, when a genetic bottleneck (Jones 2002:61) indicates a speciation event. This speciation appears to have been the, risky, adaptation of technicity. I use the term risky advisedly because a feature of technicity, creativity, is genetically correlated with depressive and bipolar disorders (Horrobin, 2002; Nettle 2002). Nevertheless, technicity must have played a key

part in the radiation of our species. We arrived in Australia, never less than a 75-kilometre sea journey from Asia, at least 60Ka ago, so we must have been able to build boats very early in our pre-history.

The character of technicity

Technicity is the capacity of behaviourally modern humans to:

- deconstruct and reorder objects; and
- deploy an external memory system.

Deconstruction and construction.

We can pluck a piece of grass and weave it around itself to make a ring. We can form the same shape from clay either by pushing our thumb through or by rolling a sausage and joining the ends. Not only can we conceptualise an entity that does not exist in nature, our musculature can produce it from varied materials in a multiplicity of ways. And, it seems, we have no clue as to how the trick is worked.

Imagination, the rehearsing of alternative scenarios, resonates with the Machiavellian intelligence shown by higher primates and the human theory of mind. But this is interpersonal imagination not an imagination that can deconstruct and reorder the physical world. There is a widely held presumption (see 1.1 above) that a mind arranged to store and evaluate subtle nuances of personality and alliance in a network of around 150 resource-sharing community members would contain the data and processing necessary for imagining a different physical world. But is the capacity to deceive the same form of intelligence that is required to imagine a paper clip unbent and re-bent to make a hook? Surely, the concept of digging up a tuber and replanting it somewhere more convenient for next year is of a different order from using the recollection in autumn of a spring flower as the signal of a potential food source?

By what neural mechanism our species is uniquely able to construct machines is very unclear (Arbib 1995, Carter 2000), However, we do know a reasonable amount about cultural transmission and the rate at which innovations are adopted – or capability lost (Dunbar et al 1999, Diamond 1998), the period being about a generation. We know from engineering history (e.g. Trevithick 1872) that innovation requires a secure cultural foundation and that most 'creative leaps' are blindingly obvious in retrospect.

The external memory system

We may have little idea how we construct but we do know that a part of the process involves regurgitating some of the contents of our mind into the environment. This we do by drawing. No chimp can do this. Inversen and Matsuzawa (2001) failed



to teach a language-using chimp to draw a line between two dots. Drawing is a capability that begins to develop in childhood around the time speech development is complete – the respective developmental periods being about three to ten years and eighteen months to four years. Speech develops much more automatically than does drawing, which has to be taught. When we talk of drawing, the standard trap is to think of art (Cox 199, Gregory 1998). Art is display. Writing and shape are far more functionally constructive.

Writing

I consider writing before shape because I want to establish very clearly the intellectual power of technicity. Spoken language is of the moment: 'I am leaving.' 'Who is she?' Writing gets speech out of the air and onto a material surface – where it can become an object of study. But 'speech' misleads us. Self-evidently a technology (Jackson, 1981), writing's earliest appearance was in accountancy (Van de Mierop, 1999). Thereafter there is a classic technology spiral, as this external memory system is developed to serve novel applications. Symbol systems proliferate (Coulmas, 1996). Intellect is liberated. We create concepts and things: think from algorithm to Turing machine (Berlinski, 2000); build the stored program digital computer (Augarten, 1985).

Shape and space

Letters are simple shapes: 'balls and sticks'. Simple shapes are unnatural and we find this hard to comprehend, so we use the language of Platonic ideals. They are also hard to draw, so we developed technologies: the straightedge and compass. Without these drawing tools engineering and architecture is not possible. With them the technology spiral led to maps, circuit boards, skyscrapers, and motorcycles. The sole possession of a penniless Richard Trevithick on his return from South America was his drawing compass. Drawing and its instruments are the means by which we make externally available our thoughts on the thing-in-the-world considered as object.

Discussion

The purpose of this paper is to suggest that a capability I call 'technicity' is unique to our species, and represents our highest level of intellectual functioning. This runs counter to the accepted view that this role is held by language. From evolutionary psychology, we may affirm a technology of language and question whether there is a language of technology. Creativity is not in language, though creativity co-opts language. Innovation is to be expected. Technicity is its intellectual driver.

This analysis poses a number of questions within and without education. Outside education, there is the question of whether technicity is growing in the population: if technicity is adaptive those 'with it' should reproduce faster than those without. Within education, the technicity notion, if supported by research, challenges the intellectual primacy of language. This would place on educationalists the burden of re-appraising language in the service of a capability curriculum founded in technicity. In support of primacy of technicity over language, may I cite Smiles (1857:482).

George Stephenson, having reluctantly accepted an invitation to join a New Year party at Sir Robert Peel's place in Tamworth in 1845, argued with Dr Buckland that 'trains ran on bottled sunlight' (the modern theory of the formation of coal). But the result was, that Dr Buckland, a much greater master of tongue-fence than Stephenson, completely silenced him. (Cf Stephenson's problems with Parliament over the Liverpool-Manchester railway.) Next morning during a pre-breakfast stroll with Sir William Follett, Stephenson 'briefed' this eminent lawyer with his theory. At dinner that night Peel introduced the topic again. The result was, that in the argument that followed, the man of science was overcome by the man of law, and Sir William Follett had at all points mastery over Dr Buckland. When asked to comment, Stephenson's reply was: 'there seems to me to be no power so great as the gift of the gab.'

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