The construction of childhood, learning and play: an evolutionary and ecological revision

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Abstract

This article provides a critique of the simpler forms of social constructionism as a paradigm for understanding play and suggests that an interdisciplinary combination of social construction and evolutionary psychology and biology is necessary. Despite recognition of the importance of play in cognitive and social development there is still a persistent view of play as something humans do – and which appears irrational or wasteful in evolutionary terms: a surplus to be to be minimised. However evolutionary biology shows that play is widespread in the animal kingdom. If play is an evolutionary stable strategy then it is mistaken to think it is superfluous and confined to humans. Nor is play a phenomenon of childhood. It may be seen instead as an essential characteristic of social communication, invention and solidarity.This echoes E.O. Wilson's work on sociobiology and the need for consilience between the social, the psychological and the physical sciences.

Key words: evolutionary psychology, sociobiology, post-natal plasticity.

The limits of social construction as a paradigm

THE SOCIOLOGY of childhood is apt to contrast its constructivist or interpretive perspectives on childhood with biological, psychological or structurally-oriented formulations. In common with many radicalisms, it may therefore be in danger of being defined by what it opposes and by a formulation of that opposition from a position of externality, or ignorance and hostility sufficient to make it untenable. This, I argue, is the current condition of the insistence on the 'social construction of childhood'. However, whilst insisting that this is a question of degree: the social construction of childhood is not itself unreasonable; it is simply not sufficient as a causal ground. Of course, constructionists will admit to the biological, physical or 'natural' dimensions of childhood. But to admit is not to theorise; the charge of possible neglect remains open.

Constructivism cannot itself be gainsaid. It is a central proposition of many disciplines, appearing if not entirely independently then at least distinctively in , for example, philosophy, evolutionary theory, cognitive biology, cybernetics, biosemiotics, the theoretical branches of the physical sciences and mathematics. Each of these disciplines concedes in its own way the traditional and ancient distinction between the construction of representations (especially representations to

oneself as humans, organisms or communities) and 'quasi-externality' to which they refer. So far as a 'solution' to that quasi-externality cannot be authenticated, construction is a permanent condition and constructivism is a permanent requirement. But this is itself a condition, not a construct. Put differently, it is an imperative demanded by reason. This does not stop unreasonable positions being taken, indeed they may be necessary to human survival; but neither does it give exemptions. Moreover it points to an important issue in the cross-disciplinary conceptions of constructivism: whereas the sociological version tends to dwell on groups' and communities' habitual perceptions, evolutionary and biological versions tend to stress the ecological sufficiency of 'perceptions' for survival. Put sharply, where the sociological version stresses at least plasticity and at most conventionality, the more ecologically-oriented constructivisms are about necessity and survival. No doubt this is due to sociology's emphasis on humans and social phenomena. The question remains: is this over-humanistic and therefore a misplaced emphasis? Conversely, would a more inclusive conception of humanity-within-the-biosphere be illuminating or still met with suspicion?

The ability to model social phenomena as *sui-generic* in the strictest sense arguably begins with Durkheim: 'Social facts do not differ from psychological facts in quality only; they have a different substratum; they evolve in a different milieu; and they depend on different conditions' (1964: 31).

The discussion must at this point leave 'childhood' and confront the more general domain of social phenomena. Surely Durkheim is right at least to some degree? Arguing from the perspectives of ecology and complexity theory, I propose that Durkheim is right to a degree and therefore also, to a degree mistaken. Note that we do not present this as a difference of paradigms but as an intrinsic and unacceptable limitation that must be overcome. The model is too simple, too uniform, too restricted to the assumed ontological priority of the social.

A complexity based or ecological model would differ in two crucial respects. The first is the concept of path-dependency. This position asserts that however different the new milieu (in this case the social) it is path-dependent upon a preceding substratum. This would not simply be 'human psychology' or biology, but mammalian ethology, as a generalised phenomenon, its causes, history and functions. The 'ecology', so to speak is not a social event but an altogether more extensive series of phenomena. They evolve in a *different milieu?* No, in *different milieux*, in time frames far older; in evolution as an all-embracing concept. Put more radically, social phenomena cannot be *sui generic* in the strict sense because nothing is 'singularly' *sui generic*. The concept of self-organisation in complexity theory is radically ecological: self-organisation with respect to others and with results compatible, robust, probable with respect to others.

Citing Morin (2002) this can be called *auto-eco-organisation*. This is a *qualitative* matter: neither the 'eco' nor the 'auto' component can be indeterminate if 'self' organisation is to emerge. Differently put this is a fundamentally ecological concept; there is no place in that ecology for a

'member' of arbitrary constitution. There must be a 'quality' of sorts, a propensity, a direction, at least a positive or negative valuation. In this sense, the status of social phenomena, I concede, is very much a second-order or *emergent* phenomenon. But second-order status should not be seen as a diminution but rather as an acceptance of the fundamentally ecological character of emergent self-organisation. Path dependency implies sets of 'good reasons' and advantages; that is, momenta towards ecologically stable outcomes that are, by definition more likely than others. This cannot stand simply on the basis of communal human preference. Where 'social constructs' persist such that they command members to respond (an entirely Durkheimian position) their 'probability' (or robustness) stands in contradiction to the notion that they 'could have been otherwise'. Path dependency, auto-*eco*-organisation and conventionality are opposed principles.

Consequently: auto-eco-organisation and path dependency require different concepts of possibility and probability. We can now emphasise that unlike Durkheim (given our radical reading) and certainly unlike postmodern theory, ecological complexity theory has a completely different concept of possibility and probability. For modern and postmodern, both humanist through and through, probability is thought in terms of human invention, relatively free from previous constraint; hence the enormous importance of both conventionality/normality and its discontents. But order of any kind, dynamic or fixed, normative or highly individualised cannot arise from indeterminacy or the absence of propensity. There must be propensity or indeterminacy will endure! And we as humans are part of, inheritors of that propensity. Certainly, we are resourceful, inventive manipulative but that is far from self-invention. The concept of probability in complexity theory is not one of authorship (given a blank slate) but rather a question of viability in a landscape that already precedes our 'creativity' and adaptation. True, the genius of our restless species lies in modifying that landscape – the lived-in environment – to suit our purposes but only insofar as we recognise and manipulate its material character. It cannot be successfully managed as a phantasm, a fiction. And part of that lived-in environment is our fellow humans.

Where humanisms of the Durkheimian, modern or postmodern kinds emphasise human autonomy, complexity theory has the much more modest notion of a degree of post-natal plasticity. This is derived from evolutionary psychology, in particular, Tooby and Cosmides (1992). The suggestion that we are less free than we think, or more radically, that our social structures, including those that constrain us, have more robust roots than the actions of privileged human ruling groups is, I admit, disappointing to a (post)modern intellectual culture reared on two centuries of promised emancipation. The counterbalance, the 'hope' lies in a rather different concept of creativity. Echoing the idea that self-organisation is not simply confined to the human and social, Kaufmann (2008) suggests that creativity itself belongs to the general properties of self-organisation: that dynamic phenomena through auto-catalytic processes are *disposed* to occupy, take up or 'explore' the 'next adjacent possible' form. This is clearly a form of dynamic path dependency. It is a defining characteristic of all phenomena that are not strictly bounded but on the contrary are able to ground

'new' or emergent phenomena. Ecologies, human or not are exclusive examples; so are physical dynamics, climate systems, markets, technologies, cultures, moral systems.

I propose then that the *sui generic* status of social phenomena is more accurately conceptualised as having a strong relation to evolution and 'exaptation'. The classic biological example of exaptation (sometimes called pre-adaptation) is the evolution of feathers. Fundamentally a form of insulation, they have been exapted to the functions of flight. A more subtle but contextually appropriate example is the exaptation of human mouthparts to generate verbal language. None of these is a limitation, for none of the developments are possible without their respective antecedents.

The problem that limits social theory by *oversimplifying* its phenomena is the assertion that they are uniquely, wholly and entirely 'social'. The implication is that they create their own ground. Not only does this neglect the ecology of competing social dynamics but authors as a matter of habit, the neglect of questions of 'archaeology' or evolution. This is so entrenched that the very mention of evolution invokes suspicions of far-right claims to fixed natures. This is a total misunderstanding. With this simple replacement of terms we at once ally sociological with biological accounts of path-dependent evolutionary dynamics. Nothing is lost: the human social preserves its salience in exactly the same way that other species do. Nothing is lost in conceding the human animal, except prejudice. No principled limitation is given to our creativity, except that is it grounded, not *sui generic*.

I can take the point further. In each of the examples cited above, the original function of the antecedent is conserved, despite its 'development'. The more neutral term is 'emergence'. That term should be understood chronologically. No sense of improvement is intended. If we concede the functionality of the antecedent (feathers as insulation) there is no implication that the later exaptation (feathers for flight) is more or less functional. It is simply an ecological possibility – and we should conclude from the success of birds, that it is an ecologically robust outcome. Similarly the exaptation of mouthparts for speech in humans presents an ecologically robust development. It may be (if we sufficiently pollute the planet) that our 'success' is short-lived. Short of our extinction, then, language represents an emergent increase in fitness or adaptation. This insight in no way limits the complexity of language: on that score, language can speak for itself. It does however, place language-as-game(s) with the emphasis on conventionality and arbitrariness in the wasteland. The *ecology* of language then moves in to the foreground.

Before progressing to further considerations, let us revisit the social constructionist perspective. Remember that forms of constructionism can be found in many disciplines. However, for most scientific enterprises, construction – especially the construction of information 'about' the physical and biological environment – is the outcome of predispositions or 'qualities' in materials, interactions or sensory systems. So, the *outcome* information generated by, say, a cat hunting

prey is premised on a previous genetic 'information' system encoded and realised in the cat's ontogeny. If social construction is *sui generic* or conventional in the strict sense then outcomes are primarily matters of chance. Put in more familiar terms, this is a direct, if unacknowledged echo of a *tabula rasa*. How then do characteristic patterns arise? Presumably by routines, habits, recurrences, repeated iterations. That is, the environment – all that lies outside the 'individual' – is the source of the way the tabula rasa gets patterns, lumps, characteristics. This is a staggeringly passive conception of so-called 'construction'.

It is not uncommon, however, in constructivist versions of the operation of power. The sociology of education is full of remarkably passive working class and ethnic minority pupils who are 'failed' by the education system, teachers, middle class ideology, or whatever. Similarly the perpetrators of these discriminatory or controlling practices are themselves acting in a semi-automatic manner. This is the implication of 'institutionalised' discrimination, or Foucauldian notions of governmentality, or the more functionalist forms of socialisation. Remember also that there is no 'drive' proposed other than randomness.

If we translate the matter into computational terms the full absurdity can be grasped. Imagine a computer that is completely blank. The simpler forms of constructionism imply a ridiculous scenario where the computer 'acquires' a word processing programme because, by chance, there are lots of words in the environment, which the computer can somehow 'sense'. But that could have been otherwise. Of course we all know that the 'programme' is actually created and put in by another rational agent. This leads to the radical proposition that constructionism that involves a tabula rasa to any degree is simply an agnostic or degenerated form of creationism, not enriched by knowledge of the sciences of emergence.

Evolutionary Psychology as an alternative

An exact parallel can be found in the understanding of play. The simpler forms of sociology understand play – and creativity – as something literally created by and unique to humans. Should the claim be more modest? Is play more like the phenomena (socio)biologists understand as the extended phenotype, something more like 'behaviours' exhibited by social insects, beavers, the higher social animals?

Both positions have their advantages and disadvantages. Unbounded creativity promises freedom but at the grave expense of conventionality. Anything is possible; anything could have been otherwise; nothing has virtue over and above anything else. In this sense the murder of Jamie Bulger was 'play'. If that disturbs or revolts you, then you implicitly refer to limits. If those limits are only themselves creations then they too are insufficient to function as limits. If, instead, we

think of limitations as part of the human behaviours necessary to survival, then an ethics grounded in the biosphere rather than the narrower sense of elected human habit becomes possible. The clear cost is the limitation of human freedom to something akin to post natal plasticity, the raising of the terrifying question of what counts as ethically 'natural' human behaviour.

We have to move to a conception of ontogeny, whether human or not whose ancestral origins and processes belong to what Durkheim ruled out: an intimate relation between the (human) organism and its entire adaptive environment. This relation is the missing 'agent' of emergent orders. As Bjorklund and Pelegrini (2000: 1690) put it:

> *Counter to some misconceptions, evolved psychological mechanisms exist in transactional relations with environmental factors. Believing that certain behaviours are under the influence of evolved psychological mechanisms does not imply that aspects of the physical and social environment do not play a critical role in the development or form of behaviour. In fact quite the opposite is true; most evolved mechanisms are quite sensitive to variations in environments and are expressed differently according to one's surroundings.*

However, the point can be sharpened. The living is better understood as an emergent possibility of the non-living environment that immediately precedes it. That is the upshot of Lovelock's *Ghaia* (1988) and Kauffmann's 'next adjacent possible'. It is also far from the 'estrangement' of human consciousness from its environment premised in Descartes, Kant and contemporary phenomenology. More precisely, if the living is seen as an event, a next adjacent possible, for a particular non-living environment then we must understand that this is a direct process of conversion. Maturana and Varela's (1980) influential concept of *autopoiesis*, virtually unknown in education and social theory, captures this. Autopoiesis means self-structuring. In the context of the living it means obtaining the necessary 'materials' from a given environment to 'convert' into the structures of the organism. Whilst this is genetically organised such that a persistent separation appears between organism and environment, it is necessarily also 'structurally coupled' to that environment. Crucially, the organism's structure 'organises' that coupling. Again citing Morin (2002) this can be termed auto-exo-reference. We are not speaking of standards of truth here but ecological viability: the thing in itself in Kant's sense is wholly irrelevant. Nor is this confined to the simpler animals: an understanding of trees 'in themselves' is irrelevant to beavers, birds, or human wood-based technologies.

I cannot pursue this in detail here but see Smith and Jenks (2006) and Hayles (1991, 1999) for a fuller discussion. However the outcome of auto-exo-reference is that humans are the inheritors of 'informational' strategies of relationship to and survival in the biosphere. These strategies include instinct and emotion shared with other species as well as the 'uniquely' human qualities of highly-developed intelligence, symbol-usage and verbal language. Where sociology, philosophy

and education tend to emphasise, or better, *assert* human uniqueness, evolutionary psychology emphasises relationships and inheritance with the physical environment and the biosphere.

Far from being a *tabula rasa*, evolutionary psychology sees the human mind as a complex anatomy of component parts that have been 'tested' across many species but also as the extreme development of intelligence, eusociality, communication and technology. There is lively debate about how 'modular' and domain/task specific these components are and whether domain-specific or domain-general attributes confer evolutionary advantage (see Tooby and Cosmides, 1992; Burgess and MacDonald, 2005; Pinker, 1997). The claim for the former is that they, so to speak, are ready to act; they simply need activation, rehearsal or 'play'. The claim for the latter is increased post-natal plasticity. Both 'have a point'. I am inclined to use the fall-back of true 'to a degree'. However I also want to stress an equally 'tangled' relationship of integration and insulation. For example, instinctive responses (such as fear) are hard-wired and immediate; in evolutionary terms they are resource efficient. Intelligent perusal – perhaps after the fact of fear – is resource-expensive and crucially, much slower. It is essential that both systems interact but also that they preserve their own specific qualities (for a fuller discussion for relationships between instinct, emotion and conscious deliberation see Plotkin, 2003 and TenHouten, 2007).

Modularity also implies constraint (Bjorklund and Pellegrini, 2000) or at least predisposition. Regions of animal and human brains show specific adaptations to certain kinds of relation and response to an environment. The discussion above on the *tabula rasa* indicates that such constraints, adaptations and predispositions are not to be viewed negatively but rather as the foundations of human possibility. Post-structuralism is wrong to see that as a threat: an adapted, evolved domain-specific conception of mind is far more positive than one shaped by chance and conventionality.

Play and developmental stage theory

Many animals play. Those with the most developed intelligence tend to play most, 'and the two traits have probably co-evolved' (Konner, 2010:500). This again underscores the evolutionary basis of play in the biosphere, rather than simply in human culture. As Konner notes play 'combining as it does great energy expenditure and risk with apparent pointlessness is a central paradox of evolutionary biology' (ibid.) However, there seems to be a reasonable consensus that play enables the development of motor and social skills and promotes skill development in interaction with the environment. Konner also mentions pleasure derived in play, between mother and infant interaction, peer interaction and individual 'practice'. Lack of play is also seen to limit development but also play itself is reduced in conditions of adversity and scarcity. Play is clearly central to human development but on the other hand, the amount of time devoted to maturation in humans points toward the paradox of risk and expenditure. There is no apparent resolution, except perhaps to

emphasise that pleasure and satisfaction itself may be part of the cost-benefit equation. Another key dimension is that 'risk' and associated energy expenditures are necessary to learning and maturation and the 'management' of risk through the simulacra of play is a 'rational' evolutionary strategy. There seems little doubt however, given our extraordinary success as a species, that the costs of prolonged immaturity generates benefits, if deferred.

I propose to concentrate on a rather tautological answer to why human maturation takes so long: because nature cannot do it any faster (see, for example, Burgess and MacDonald, 2005). There is a physical dimension to this, which is by no means exclusively human. That is the relationship between head size and the female pelvis. The more important dimension is related to the maturation of the adult brain. Again this is not unique but is particularly significant in humans. The idea that capabilities, for example language, have to be activated, rehearsed, developed, especially at critical developmental points is well known. An implied but not well-developed idea, certainly not in popular academic consciousness, is the importance of parallel processing in functioning consciousness (for a fuller discussion see Dennett ,1991; 2003; Smith and Jenks, 2006). These are in turn crucially active in humans as an intelligent, adaptive and eusocial species.

I do not propose to develop the first of these here. I merely want to stress that the activation of any faculty or capability in any species in relation to its actual environment is crucial to survival. Unlike the Utopian simplicity of social construction *ex nihilo* without limit and implicitly without risk, the outcome of this co-construction could be negative, disastrous, even fatal. Taken further, this underscores both the necessity and risk of embodied and adapted cognition. Contemporary learning theory (Illeris, 2009; Jarvis and Parker, 2005) aided by cognitive science points to the maximisation of adaptive synapse production and connection in childhood, especially from birth to five. At the same time there is redundancy and elimination: repetition reinforces 'hard wiring' whilst its absence induces selective pruning. This is clearly risk laden: the development of cognitive adaptation to one environment may preclude or produce obstacles to the successful adaptation to a different environment. The concept of (human) play that follows from this is one of building motor, sensory, emotional and social expertise. Illeris (2009) and Jarvis and Parker (2005) characterise this stage as active but acquisitive, very much learning about. Perhaps one could say that the 'exo' dimension is maximised and necessarily so, since the young child is very much 'learning to be'. Whilst 'active' in the sense of needing performance and engagement there is a sense of autonomy, or drive, or imperative in the concept of play and learning at this stage: adaptation to an environment is, in a sense, 'demanded'. Following Alexander (1989), Burgess and MacDonald (2005) also propose that the predominant factor, indeed the greatest threat, to modern humans is other humans. This, it is argued, is the involuntary drive behind the need to ratchet up human intelligence (see Burgess and MacDonald, 2005:88).

For later adolescence, (Stein, 2005) the situation is somewhat different. Where early childhood

is characterised by synapse production and 'pruning' occurs as a sort of natural wastage – the elimination of the insignificant or non-repetitive, post-puberty, the pruning process is radical and pro-active. The question of social identity formation with respect to peers becomes dominant. One might say that given auto-exo-reference, now the 'auto' pole is expressed as the dominant one. Differently put, this is work on one's social identity, the sharpening of highly specific adaptation. As Durkheim's concept of organic solidarity or TenHouten's work on the emotional structure of social relations teaches us, this role-formation is necessary. It is the construction of a socio-ecological 'niche'. But any emphasis on the 'auto' rather than the 'exo' is also risk-maximising. An identity tightly formed in childhood or adolescence in one environment may turn out to be dysfunctional in another. Could this be why many of the commitments of youth culture are seen as chaotic from the outside?

To conclude this section, I now propose that the natural or normal form of human behaviour occurs within or around an attractor shaped by key ancestral evolutionary forces of survival: intelligence, adaptability, eusociality but also by the actual contemporary social and technological environment of survival. This is why sociology and the social 'construct' must recognise the agency of ancestral adaptation and become an interdisciplinary concept.

The I/me relationship and parallel processing

The constructionist perspective reasserts itself with vengeance in the I/me relationship, which is arguably most fully developed and expressed in humans (though of course its forms must be ancestrally present in species-specific forms in social animals). The problem, simply is that I, as I appear to myself and 'me', as the object of another' perception, remains my perception. Whilst this perception is necessarily interactive and has strong elements of reciprocal influence the facts of guesswork, hypotheses, prediction and self-signalling are central. I/me is better understood as a continuum or what Dennett (2003) saliently terms a smear: identity is this smear. Perhaps this allows us some insight into the paradoxical length of time spent – or squandered – on play: it is a necessarily open process of signalling, interpreting, concluding, repositioning that knows no end. Perhaps we could compare it to linguistic 'competence' which is in one sense a contradiction since it is without limit. This is not rare in the biosphere or human culture: basic levels of competence or the ability to perform a behaviour without major risk by no means rule out constant elaboration. In this sense we may be mistaken in thinking that the play stage is surprisingly long in humans. Rather the play stage is rarely, if ever complete. It simply transforms itself into adolescent and adult stages, informed by their own cultural milieu. This why we think of music making as 'playing' something, or the arts as creativity and at the same time continue to 'reserve the right' to regard them as superfluous, excess. Without stretching the imagination too far, a hugely significant proportion of human activities could be regarded (mistakenly) as instances of excess when they

might be better understood as exploration of the next adjacent possible.

Parallel processing is almost never discussed in this context. Indeed any consideration is rare except for arcane technical discussion. Dennett (1991, 2003), has been active in bringing it into philosophy or non-specialist consideration. Put simply 'wetware' or biological information processing systems, especially the human brain are utterly unlike hardware/software in computers. The former exhibit massively parallel processing, the latter, despite sophisticated development remains massively serial. The functionality of serial processing depends on carrying out specific instructions or iterations one at a time but with fantastic rapidity. The economic production of serial units is for example, present in 'ordinary' family cars with, say, anti-lock systems; the adverts routinely claim 'millions of calculations a second'. The term 'components' is apt and echoing the discussion above, they are highly modular.

The discussion here must be extremely abbreviated but several dimensions should be mentioned. First, the human brain shares a history of development with other species. Certain parts of the brain as an anatomical complex are far older in evolutionary terms than others. Second, there is clearly a degree of modularity. Humans uniquely have a 'module' that makes symbolic language possible. At the same time there is debate, as indicated above, how domain specific or domain general these modules are. This, in effect, raises the third dimension which I want to consider here as the degree of integration between or insulation of the modules is evident. Fourth, there is the related question of levels of consciousness, of intended or 'automatic' responses. Fifth (you may usefully compare this with the car) is the ability of individuals to adapt and exploit differentially and so influence their status now and for both natural and cultural 'offspring'. The list is of course merely indicative and we are only in a position to consider some implications, no 'answers'.

If we propose that both domain specificity and domain generality are true to a degree and that there must be some level of integration between older, simpler and newer more complex, it sounds like an evasion, possibly necessary at this stage but certainly not without profound implications. Given this proposition then, we can reduce our five dimensions, I propose, to three: Un/subconscious processing, conscious end-directed behaviours, but also something between the two. This dimension is rarely addressed and has no accepted name. Dennett (2003) refers to them as expert routines. I prefer to stress that they are so rehearsed, practised, *played with*; they do not demand fully conscious deliberation, indeed at times they may be subconscious.

Unconscious systems, such as the immune, respiratory and digestive systems, in evolutionary terms, precede, and do not require 'completion' by conscious deliberation, though malfunctions may induce consciously experienced symptoms. Conscious manipulation and deliberation are everyday experiences we take for granted. Those 'in between' pose more problems. It is obvious that learning to walk requires conscious deliberation but, in time, becomes such an expert routine

that it demands little conscious deliberation. Those with leg injuries may, however, need to re-deliberate in order to recover. From personal experience of a relatively minor injury that takes time, practice and considerable cost. However, most of us have forgotten learning to walk – which rather underscores the point. Moreover, there are many activities we have learned and forgotten: learning to read for example. Learning to drive, however, is often within recall. Remember the level of deliberation needed? Recall the urge to look at the foot-pedals? How much careful thought did road positioning take? After a considerable amount of rehearsal, driving becomes almost subconscious – but, with the interesting revision that it can be brought instantly to full consciousness when decisions need to be made or where adverse conditions threaten. This is the characteristic of expert routines – one can literally forget to drive when one becomes expert but instant recall is at your disposal.

It also underlines the particular character of parallel processing. You may be listening to the radio or thinking about a problem, minding the children in the car, participating in a conversation, but the expert routine is there, just below the process you are conscious of, just below consciousness itself, yet active, skilful and open to immediate recall. Perhaps this ability of expert routines to run almost but not entirely automatically is what demands such long periods of rehearsal. Now put this in the context of learning to speak, learning to read, learning what is socially necessary, mastering the co-ordination of the body and it becomes much more comprehensible that play and learning take so much time. This 'repetition' amounts to the automatisation of behavioural repertoires such that parallel processing is possible. Indeed, having spent a great deal of time trying to help 'serious' non/poor readers (with modest success) it is very clear that the inability to make fairly automatic, and so 'expert', some basic aspects of literacy has huge implications. The poor reader, like the raw learner-driver has to consciously deliberate everything; there is no take-for-granted foundation. But if you can assist in the synthesis of such a foundation, progress becomes possible.

It is not simply that skill acquisition takes time – bird flight, for example is massively impressive yet accomplished quickly. It is rather that play, rehearsal and learning particularly in humans has to create a massive and varied repertoire that is both integrated and isolated to the 'correct' degree. All of that too, must be integrated/isolated with other humans. We may, then, be 'theoretically' surprised by the time devoted to play and the slow pace of maturation, but in practice it is the prodigy who accomplishes things at remarkable speed that is the rarity and the true surprise.

In place of a conclusion

It seems presumptuous to offer any sort of conclusion when, in fact, I am proposing the opening, or at least the redevelopment of a field of study. We are, frankly, just at the outset. However some broad implications are clear.

1. Play is not confined to human children but on the contrary is widespread amongst the larger-brained species.

2. The idea that play is superfluous is flatly contradicted by being widespread across species. In humans it is clearly a persistent evolutionary stable strategy. That completely refutes any notation of excess. That is a mistake comparable with saying that birds, butterflies or flowers would be more 'economical' if they were less 'excessively' coloured. Nevertheless the idea that play is a waste of time is strongly embedded in British education; a fine example of a social construct that is palpably false.

3. Play is not confined to human *children*, nor does it decline with age. The argument that it simply changes its form in adolescence and adulthood is at least plausible. Again related to the excess thesis or surplus value doctrine in Marxism, behavioural repertoires in human collectives that appear to have no direct, positive cost-benefit outcome are widespread. That does not mean that there is no benefit but rather that we misunderstand it. Given the sheer volume and variety of resource expenditure we devote to what the parsimonious might call unnecessary, this too must be a social construction that has become not only derelict but an obstacle to understanding.

4. There is fascinating work on the relationships of emotion to social action (Tenhouten, 2007; Tracy, Robins and Tangney, 2007) and closely related (if not acknowledged) study with behavioural economics (Loewenstein, 2008; Ariely, 2009) on what appears to be irrational human behaviour in cost-benefit terms.

5. We *must* lose our phobia about evolutionary psychology. The perversions of eugenics and racism cannot be grounds for the illusion of self-creation. Would the term *ecological* psychology be more acceptable?

6. Evolution and self-organisation are closely allied theories. They are thoroughly neglected in the humanities, sociology and education. They provide our best chance of some sort of consilience with the sciences. They cannot be ignored.

7. Understanding that the brain is not analogous with a serial computer but is rather a cluster of parallel processing systems is essential. There is the beginning of an attempt to provide a holistic version of past and contemporary learning theory that is not ashamed of evolution, biology or ecology (Kahn and Kellert, 2002; Jarvis and Parker, 2005; Illeris, 2009). Modern developments in neurobiology are acknowledged in this work, together with the sobering fact that our understanding of the brain and learning is in its infancy.

Darwin gave us the founding tautology of the survival of the fittest. Put differently, that which can survive, will survive; that which can happen, may happen even if only a fraction of possibility is made actual. We must embrace the consequence: a discipline founded on the ontologically possible, robust emergence, without preconceptions based on older systems of belief or preference.

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