Can there ever be a non-specific adaptation?

A response to Simon J. Hampton

Thomas E. Dickins
School of Psychology
University of East London
London E15 4LZ
United Kingdom

+00 44 (0) 20 8223 4005
t.dickins@uel.ac.uk

Abstract

Recently Hampton (2004) has argued that natural selection could have equipped the human mind with a set of adaptations for nothing in particular. In this way Hampton challenges the current orthodoxy of Evolutionary Psychology, which claims the mind is a collection of domain-specific cognitive mechanisms. This paper outlines the core of Hampton's thesis as well as the key commitments of Evolutionary Psychology. This is followed by a discussion of the principal levers of Hampton's argument, which are the problems of uncertain futures and of social novelty. Both of these problems pertain to flexibility in the face of new inputs, and Hampton claims that our ability to deal with such situations is indicative of an underdetermined, yet evolved, cognitive architecture. This paper rejects these problems on the grounds that they are misconstrued; a system that can process an input can only do so if it is prepared to do so, therefore true novelty would defeat an organism. This rejection is more formally expressed in terms of information theory, and the various consequences of this conception are drawn out. The paper concludes with some comments about the appropriate grain of analysis for evolutionary theory within the behavioural sciences.

Introduction

Hampton (2004) has recently discussed the application of evolutionary theory to the behavioural sciences. In his paper he argues that social situations are so unpredictable that the optimal evolutionary response is to select for a social-cognition adaptation, or social intelligence, which he refers to as an adaptation for nothing in particular.

This paper will begin with an outline of Hampton's arguments in which he details the problem of unpredictability. It will then go on to describe Hampton's proposed solution and finally present some criticisms of his solution that are firmly embedded within contemporary evolutionary theory.

Two Evolutionary Traditions

Hampton identifies two evolutionary traditions within the behavioural sciences – evolutionary psychology and human behavioural ecology. Evolutionary psychology rests on the view that the human mind is a set of adaptations, a collection of computational devices that have been selected to solve ancestral problems. These devices, or modules, are constituted by conditional computations that take an input and deliver a behavioural output. Modules solve adaptive problems that occur in specific domains. Just as the human body is composed of individual organs that solve problems such as locomotion, eating etc., the human mind is constituted by mental organs that deal with specific problems.

To illustrate this position Hampton describes Cosmides's (1989) classic work on social reasoning. Following from the canonical game theoretic work of Hamilton and Trivers on reciprocal altruism, in which it was found that certain behavioural strategies, notably a tit-for-tat strategy, are evolutionarily stable when an uncertain number of repeat interactions are likely between two individuals, Cosmides looked for signs of an evolved psychology that would facilitate such adaptive behaviour. In particular, Cosmides realised that groups engaging in reciprocal exchanges would not be stable if cheats were able to flourish. Given that there is reciprocity Cosmides reasoned that there must be evolved psychological mechanisms that address the specific problem of possible cheating.

Cosmides used the Wason Selection Task, which was originally designed to investigate people's ability to perform abstract conditional reasoning. This task presents participants with four cards. Participants are told that each card has a letter on one side and a number on the other. They can see A, D, 4, and 7 on the presented cards. A rule is then given, such as "If a card has an A on one side then it will have a 4 on the other side." The participants are then asked to state which cards they ***must*** turn over in order to test this rule.

The rule takes the form $p \rightarrow q$. In order to test such a rule one should seek to falsify it and select the *p* and *not-q* cards, in this case A and 7. Overall less than 25% of participants, and typically it is lower than this at around 9%, draw the correct inferences when using abstract conditionals and instead most people tend to select the *p* or the *p* and *q* cards (see Evans et al., 1993). Cosmides saw that the basic conditional logic of this task is of the same structure as that required to perform a tit-for-tat reciprocation, yet under the abstract version of the task people who otherwise understand reciprocation do badly. She decided to alter the task by contextualising it in a social contract situation; for example, she would present cards and tell the participants that on one side of the card is an age and on the other a drink. The participant had to pretend that they worked in bar and were checking for underage

drinking. The conditional rule would be "if a person is drinking alcohol then they must be 18 years or older." The cards presented would have 18, 15, beer, and coke printed on them and the participants would be given the same instructions as before. The majority of participants choose *p* and *not-q* this time, in other words, the beer and 15 cards.

From many such experiments, under a variety of different social contracts, Cosmides collected the evidence she required to support her prediction that humans have an evolved cheat detection mechanism that is sensitive to social contracts and their violation. This is an essential aspect of establishing reciprocation over time and avoiding costs brought about by defectors. The key point to draw from this is that the logical reasoning performed by participants in these tasks has, as Hampton states, a natural history and is contained within a domain-specific modular device. When we try to stretch that logic beyond its natural domain we find it incredibly difficult and we generally fail. The mind is made of many such devices and as such is an adapted mind[1].

By contrast, Hampton claims that human behavioural ecology is not specifically interested in the architecture of the mind and instead turns its focus to behaviours under various ecological conditions and competing demands. The assumption is that the mind is flexible and capable of calculating optimal decisions, where optimality is understood in terms of positive fitness consequences. Hampton describes the position as follows:

> The range of subtle and complex trade-offs between opportunity and cost aimed towards the singular end of Darwinian fitness serves to highlight the adaptive (as opposed to the adapted) property of the human mind. The basic point is that one cannot get flexible behaviour out of inflexible psychological adaptations. (2004: 37)

Evolutionary psychologists would not argue with behavioural ecologists about the complexity of problem-space confronting humans, but would instead argue that the human mind has multiple modules, that natural and sexual selection have broken the overall problem-space into discrete domains and found cognitive solutions for each. As such, when doing psychology we must think about the past functions of behaviours, or rather about ancestral adaptive problems, and use this to functionally decompose the overall cognitive architecture. Following from this, according to Hampton, evolutionary psychologists argue against the human behavioural ecologists by stating that "one cannot have a mind adapted to solve the general problem of inclusive fitness because there is no such general problem" (2004: 38; see below).

It is to this argument that we now turn.

Uncertain Futures

Having an adapted mind arguably presents what Plotkin (1995) has referred to as the uncertain futures problem. Hampton raises his own version of this problem. If an organism is constituted by evolved traits, it will meet novelty equipped only with the solutions to ancestral problems, for evolutionary change is a slow transgenerational process. A mismatch between an ancestral mind and a modern future is possible, and

[1] More recently Cosmides and colleagues have demonstrated these effects cross culturally (Sugiyama, Tooby & Cosmides, 2002) and found neurological evidence in support of such functional organisation (Stone, Cosmides, Tooby, Kroll & Knight, 2002).

potentially disastrous. However, Hampton implies that many species have apparently developed ways of dealing with such uncertainty, and he describes one putative psychological solution:

> (W)hat we typically call intelligence and rationality is an adaptation to solve for uncertainty…. (I)ntelligence allows organisms to adjust their behaviour according to "wobbles" in the world. As an adaptation, intelligence is for nothing in particular other than serving inclusive fitness. Before its actual exhibition one cannot say what it is intelligence will do, or how it will adjust, unless one is able to specify exactly what uncertainty will be faced… (2004: 47)

Hampton is clearly stating that one cannot predict what the faculty of intelligence will produce, neither cognitively nor behaviourally.

Hampton takes seriously the consensus view within evolutionary psychology that we are a highly social species and that the human brain has evolved in the context of a complex and dynamic social problem-space. Following from this, humans have faced (and continue to face) socially uncertain futures and this leads Hampton to draw out three implications:

> The first implication is that psychological mechanisms… are relegated at the expense of content. The second implication is that social uncertainty as a selection pressure was non-prescriptive. And the third implication is that if we cannot say what a given adaptation is for we need to relax our definition of the term or abandon the hope that we can specify its operation. (2004: 48)

The first implication refers to the emphasis of evolutionary psychology upon computational devices that implement conditional rules and deliver appropriate behaviours. Hampton is claiming that, within evolutionary psychology, content is privileged over process, such that an algorithm that prescribes the conditional operation $p \rightarrow q$ is only "in place" because of the adaptive significance of situation p and behavioural response q[2]. In this algorithm, p is a statistical composite of ancestral cues from a putative environment of evolutionary adaptedness: and for social problems evolutionary psychologists should be discussing, and looking for, social cues. Cosmides's facilitation of performance on the Wason Selection Task through the use of social context is just such an example of manipulating social cues, i.e. the inputs to the mind, under the assumption that they match stored content.

Hampton asserts that social interactions, and hence social problems, are "potentially endless" (p.49) in their form. Given this, any content that has been selected, i.e. any fixed p inserted into a computational process, will not allow the organism to deal with future social situations – in other words, they will have radically uncertain social futures and such a rigid system will not be able to deal with this novelty. Therefore, Hampton concludes that "(h)uman minds are adapted to adapt to other minds" (p.49) and in this sense social uncertainty is a non-prescriptive selection pressure, which is Hampton's second implication. Accordingly Hampton argues that we can only ever note the adaptive good fit of a particular aspect of social cognition after the event, and we can never take the content of, say, a particular belief

[2] Elsewhere, Samuels (1998) has made the related comment that the Darwinian Modules of evolutionary psychology are a blend of computational processes (a la Fodor's (1983) original conception of modularity) and domain-specific representations or content.

and predict its effects on the rest of social cognition and subsequent behaviour[3]. This last point is made with especial reference to cognitive dissonance, which Hampton has earlier claimed to be a candidate adaptation because it allows us to monitor novelty at the same time as trying to maintain a consistent model of the world. Any inconsistency will lead to tension and a need to address this. Hampton's concluding comment is as follows:

> Generally speaking, human minds are adapted in the biological sense of the term. The important point about this for social psychology is that minds are adapted to other minds. However, in being adapted they need to adapt to one another. Resting on the view that what we have left when a comparative analysis between humans and other species is exhausted is our elaborate social lives, I argue that evolution has produced adaptations for nothing in particular. These "adaptations" are about other people. But because others are not and have not been entirely predictable, these adaptations are not best described in mechanical … terms. Natural history suggests to us that we cannot exhaustively detail this adaptation because we cannot exhaustively detail social life. (2004: 51)

A Summary of Hampton's Position

Hampton concedes the basic logic of evolutionary psychology, that the mind is constituted by adaptations to ancestral problems. What is more, Hampton agrees with most contemporary theorists that a key selection pressure, which led to much cognitive innovation, came from the social world. However, he argues that the social world is both complex and unpredictable, and this leads to potentially endless social problems with fitness consequences. Therefore, in line with his characterisation of human behavioural ecology he claims that there is a requirement for a general ability to reach optimal social behavioural decisions, and this is to some extent characterised as an online capacity. This general ability, let us call it social intelligence, has been selected for and is to be regarded as a set of adaptations: but because the domain of operation is, according to Hampton, intrinsically unpredictable, there is no one selection pressure or adaptive problem that can characterise these adaptations – they are for nothing in particular. In this way Hampton has attempted a synthesis between evolutionary psychology and human behavioural ecology.

Hampton's thesis is problematic. It is to the central problems of his argument that this paper will now turn.

First Problem: What constitutes social novelty?

Hampton's thesis is predicated upon an assumption of endless social novelty. This is at no point defended or clearly defined and leads one to worry about the grain of analysis at work. On one hand most people would concede that every social interaction is idiosyncratic for a number of potential reasons, such as the people involved, the fine detail of the discussion at hand etc. On the other hand, however, one can note a huge amount of similarity across such situations as the label "social" seeks to imply. For example, some situations are negotiations about sexual behaviour, some about food sharing, and some about who owes what to whom. It is

[3] One might ask to what extent this is the stated aim of any science of social behaviour. Did the founders of dissonance theory, attribution theory and social identity theory really lay claim to such small scale prediction?

precisely at this grain of analysis that the selection pressures that evolutionary psychology alludes to operate. To argue that there are an infinite number of such social categories would need defending, and would, I submit, do huge damage to the term social.

Another way of thinking about this is to see any evolved content for *p* as setting the parameters for acceptable *p*-type inputs. *p* describes a set of *p*-types. Equally, the output *q*, describes a set of *q*-types. Compare this with the visual system and its computations. The human eye has evolved to take a range of inputs of light, from wavelengths *a* through *n*. This is a large set, and the configurations of light patterns that can possibly be inputted are potentially infinite. However, the computations that process light input only operate over certain features of the input, are only sensitive to certain gradations of shade etc., and apply a large amount of innate knowledge to build visual images. This internal knowledge is a veridical representation of certain features of the external world, and is the consequence of natural selection operating in a particular ecological niche. What is more, this evolved (adapted) perceptual system establishes an *umwelt*, a set of inputs from which later inferences can be drawn leading to the production of behaviour.

The key question to ask of Hampton is, in what sense are the social inputs he discusses different in magnitude and novelty from those entering the visual system? In short, our visual system is one among many that takes inputs from a potentially infinite input space, but does so in a selective manner and thereby reduces this to a computationally tractable task. The first selection is the parameters for a "visible" spectrum, and then there are filters for feature detection, distance, three-dimensionality etc.

Second Problem: What does it mean to have an uncertain future?

Hampton makes much of uncertain futures, but as with social novelty this concept is taken as a given with no defence and little explication.

We can use vision again in order to demonstrate a problem with Hampton's use of future uncertainty. The visual world is in no sense temporally invariant – for example, for every novel social situation there is a novel light pattern associated with it, and social situations are not the only things that can be looked at. Therefore, the visual system suffers the "uncertain futures" problem also, but only at the grain of analysis that focuses upon individual light-reflecting events. When looked at in terms of a coarser grain, such as that of detecting movement, faces and objects, then futures are less uncertain – although these things could, in theory, all change radically such a change is likely to be catastrophic and in some senses of no interest to evolutionary theory.

Third Problem: Information, preparedness and generality

Hampton notes that evolutionary psychology is in the business of developing a "picture of the information processing procedures that govern human behaviour" (p. 36) and he sees this as the hallmark of psychological enquiry. This view has certain consequences that when spelt out cause problems for Hampton's hypothesis.

Information is a term used to describe the functional relationship between an input and a system. A system that can exist in a number of different states can be described as being uncertain. Any input that "flips" the system into a particular state

reduces this uncertainty and is informative. This simple idea is at the core of Shannon's (1948) definition of information.

An important lesson to draw from Shannon is that inputs are only informative if the system they interact with is prepared for them. This means that the intrinsic design of that system is such that a given input will cause state change. So, petrol plays an informational role in a petrol engine, but water will not, even though you can add water to the system. Engines are designed by engineers, but the functional design we see in nature is the result of natural selection. These natural systems include anything that adopts states, such as the lungs, the eyes, and the brain. In this sense humans, as organisms, are constituted by a large number of physiological and psychological information processing mechanisms. Information processing is not just the preserve of psychology.

Natural selection generates information through the design of organic systems that can use specific inputs. This is surprising:

> Because the second law of thermodynamics states that physical systems tend to move toward more probable states, they tend to move away from organization on their path toward maximum disorder… Even more depressing, as highly ordered physical systems, organisms should tend to slide rapidly back toward a state of maximum disorder or maximum probability (with death occurring at some intermediate point in the decline, shortly before rot). (Tooby, Cosmides & Barrett, 2003: 862)

This phenomenon is also referred to as entropy and Shannon relied on this concept in order to express the concept of disorder and uncertainty. Natural selection is operating against this, as do organisms in their day-to-day existence. Organic life, then, is in a precarious state and it might seem that changes to the environment will be catastrophic for organisms adapted to an earlier version. But there are degrees of environmental change; and natural selection endows organisms with intrinsic design that allows a certain tolerance of expected change. This tolerance, or flexibility, is a consequence of decision rule architectures of the sort discussed above. None the less, radical environmental change requires additional intrinsic design and this is achieved (if at all) through mutation and the selection of variation in genetic expression.

This discussion of natural selection and information clearly applies to the preceding two problems. If inputs are only informative as a consequence of design then new inputs, that the system is unprepared for, can have no systemic effect on their own. The only chance for an effect is after a period of redesigning. So, any social input we can process cannot be truly novel and any future we encounter and deal with has been predicted by our evolved intrinsic design.

The idea of an adaptation for nothing in particular is also problematic following the preceding analysis. Hampton clearly sees adaptations for nothing in particular as psychological systems that impact fitness, and have been selected for, but that have no domain-specific content. Hampton, as we have seen, criticises evolutionary psychology for privileging content over process, and the implication he seeks to draw is that an adaptation for nothing in particular would be process based. So, for example, Hampton hypothesises an attribution adaptation for nothing in particular that is presumably able to deal with attributions and attributional situations by dint of domain-specific algorithms and nothing else. This adaptation, as a consequence of these properties, would be flexible in the face of novelty. But the trouble with this analysis is that the processes that implement algorithms within a system only operate over the inputs they are designed to accept, as we have seen. By reducing the "authority" of content in his adaptations for nothing in particular

Hampton places himself in a theoretical bind. For domain-specific computations to work they must have a method of determining appropriate inputs to operate over. If they can achieve this they effectively have stored content. The statistical composite representation of *P*, that evolutionary psychologists lay claim to, can be instantiated in a number of different ways, from a prototypical concept, to a theory of *P*s, through to a structural bias that only allows *P*s into the system, but how so ever this is achieved it amounts to content. The only remaining possible option, if one wishes to reduce the privilege of content, is to argue for a domain-general computational system that can operate over a number of different problem spaces, but that can be directed to specific social problems, such as attribution, as and when required. But this too is troublesome, for it amounts to a model of general intelligence.

Evolutionary psychology is opposed to the notion of general intelligence (Tooby and Cosmides, 1992). The simple argument is that for there to be an evolved psychological mechanism there has to be a specific problem that it solves, a problem that bears upon fitness. A general intelligence device could not evolve because there is no such thing as a general problem that would provide a selection pressure. What is more, if this device can deal with problems that cannot be predicted, then how did natural selection ever manage to shape such an adaptation? If there is no immediate problem, then there is no immediate solution and there are no abilities leading to this solution that can be selected. In short, this argument violates the logic of evolution.

One reply to the above argument might be that a form of general intelligence device could be selected by exposing an organism to many problems and, because there are similarities across problem domains, a general solution could be found and a device selected. But, if the similarities across problem domains are sufficiently close to render one solution appropriate, one is arguably dealing with a single kind of problem in the first instance, and a specific adaptation to solve it. What is more, if one wishes to argue that general intelligence is in some way able to note similarities across any problem domain (and in principle one can find similarities between even cheesecake and the Conservative Party, with enough diffuse analogical work) it is not clear how this would confer an adaptive advantage, i.e. the ability to translate such analogical reasoning into appropriate behaviours under different situations, without recourse to some domain-specific devices at the end of the day. The core notion of flexibility is not challenged here, but this flexibility will be domain-specific, the property of each psychological mechanism, not of one (as yet unspecified) overseeing device.

Which ever way we cut this it appears that there cannot be cognitive device that is for nothing in particular. Domain-specific content is an essential feature of information processing systems.

Associated with the above arguments is an equally serious issue for general intelligence arguments which serves to force the point – that of the frame problem. This is a problem of computational tractability. If cognition truly were a general process operating over all contents then the job of searching through stored representations and extracting the appropriate ones and then running the associated behavioural routines would be extremely time consuming. The more complicated an organism's ecological niche, and therefore the more numerous the problems that organism faced, then the longer such a search would take. This would soon become maladaptive, for more times than not a behavioural response is needed quickly.

The frame problem plagued artificial intelligence research for some years until the solution to store knowledge (or content) in domain-specific discrete packages was hit upon. Given a suitable trigger input the appropriate package (or module) would be

activated and the machine would respond quickly. Evolutionary psychology is well aware of this solution, and Tooby and Cosmides (1992) discuss it at some length noting that evolution through natural selection can solve this problem for organisms in precisely the same manner.

Conclusion

Emerging from the criticisms above are two overarching themes. First, there is an issue about the grain of analysis that is appropriate for evolutionary arguments. Second, there is an error in the direction of argument employed by Hampton. These two themes are related to one another.

As we have seen, Hampton's insistence that there is a huge amount of social novelty in the world can be attributed to a focus upon observations of individual social events at a grain of analysis that might best be termed historical. Here the term historical is used to convey a sense of detailed reporting of events almost on a real-time basis, such as an historian might use to analyse the events leading up to the assassination of Rabin in November 1995. In such an analysis the power brokering, the symbolism of the Arafat-Rabin handshake on the White House lawn and other events that preceded a growing disenchantment amongst radical right wing Israelis is relevant. One needs to know the actual arguments and how they relate to each other and to eventual actions. This is a focus upon tokens of social behaviour. However, for an evolutionary psychologist the grain of analysis is coarser, and might best be termed long-historical. Such a long-historical view would note that murderous behaviour is often the result of drawn-out conflicts over resources such as land, but is none the less comparatively rare due to the costs accrued by such actions. This is a focus on types of social behaviour. It is at the long-historical level that natural selection operates.

Hampton's thesis has a particular direction of argumentation. He begins with an assertion that the social world is complex and unpredictable and uses this to weaken the position held in evolutionary theory generally, that an adaptation is a response to a specific fitness-related problem. With such a changeable world an adapted mind, constituted of fixed content, could not possibly cope, yet humans do cope, therefore the mind cannot be as fixed and adapted as evolutionary psychology claims. The trouble with this argument is that the initial premise of a complex and unpredictable world can only have been generated through an historical-level analysis of social behaviour. Evolutionary processes operate, as said, at the long-historical level, running over historical-level events and effectively noting similarities across domains and dissimilarities between domains. Given this, it is not legitimate to attempt a refinement of evolutionary theory by using an historical-level analysis of any kind. In other words, Hampton needs to provide a reason to rethink the level at which selection works.

There is another way to conceptualise the problem of the direction of argument. If one takes an evolutionary approach to social behaviour and social psychology one needs to go beyond the simple fact that modern *Homo sapiens* evolved in a social environment, and that this impacted on their cognition. One needs to ask the more radical question of how social life itself emerged and why. A typical answer to this question might involve discussion of the benefits conferred by group living, such as increased survival chances through group action and the reduction of each individual's probability of being the one chosen by a predator. Furthermore, such benefits are likely to be more pertinent under certain ecological conditions, such

as the deforestation around 6 million years ago that forced our ancestors into much more open land, where they were more vulnerable (cf. Dunbar, 1996). As soon as group living emerges new costs also emerge, and these must not outweigh the benefits of group life. Costs may well be associated with increased competition for food and sexual resources. Given these factors there is a constant tension between fission and fusion – individuals will compete for their own benefit but not at the expense of their group membership. It is from such tension that selection pressures for fine-tuned social cognitions, which facilitate competition but also an awareness of when to back-off and accept a loss, emerge. As individual group members become better at such judgments over long-historical time, so the dynamics of the social interactions alter and the social selection pressures within the group change. It is the adapted social minds of our ancestors that altered the social economy and led to new social selection pressures.

Hampton appears to think of social behaviour as a source of potentially infinite variance within the environment and in so doing makes the error of divorcing social phenomena from the species producing it, of understanding social behaviour as a force to be reckoned with rather than as an adapted output with feedback consequences. It is our adapted minds that react to and produce current social historical-level events. These adaptations set the parameters for the types of social behaviour we produce and these types can only be changed over long-historical time. Given this Hampton cannot begin his argument in the way he does, and we have no reason to believe that there can be an adaptation for nothing in particular.

References

Cosmides, L. (1989). The logic of social exchange: Has natural selection shaped how humans reason? Studies with the Wason selection task." *Cognition 31*: 187-276.

Dunbar, R.I.M. (1996). *Grooming, Gossip & the Evolution of Language*. London: Faber & Faber.

Evans, J. St. B. T., Newstead, S. E. & Byrne, R. M. J. (1993). *Human Reasoning: The Psychology of Deduction*. Hove: Lawrence Erlbaum Associates.

Fodor, J. A. (1983). *The Modularity of Mind*. London: MIT Press.

Hampton, S.J. (2004). Adaptations for Nothing in Particular. *Journal for the Theory of Social Behaviour*, *34* (1): 35-53.

Plotkin, H. (1995). *Darwin Machines and the Nature of Knowledge*. London: Penguin

Samuels, R. (1998). Evolutionary Psychology & the Massive Modularity Hypothesis. *British Journal of Philosophy of Science*, *49*: 575 - 602.

Stone, V.E., Cosmides, L., Tooby, J., Kroll, N. & Knight, R.T. (2002). Selective impairment of reasoning about social exchange in a patient with bilateral limbic system damage. *Proceedings of the National Academy of Sciences (PNAS), 99 (17),* 11531-11536.

Sugiyama, L.S., Tooby, J. & Cosmides, L. (2002) Cross-cultural evidence of cognitive adaptations for social exchange among the Shiwiar of Ecuadorian Amazonia. *Proceedings of the National Academy of Sciences (PNAS), 99 (17),* 11537-11542.

Tooby, J. & Cosmides, L. (1992). The Psychological Foundations of Culture. In: *The Adapted Mind: Evolutionary Psychology & the Generation of Culture*. Barkow, J. H., Cosmides L. & Tooby J. (Eds.) New York: Oxford University Press.

Tooby, J. Cosmides, L. & Barrett, H.C. (2003). The Second Law of Thermodynamics Is the First Law of Psychology: Evolutionary Developmental Psychology and the Theory of Tandem Coordinated Inheritances: Comment on Lickliter and Honeycutt (2003). *Psychological Bulletin*, *129* (6), 858-865.

Acknowledgement

I should like to thank Oliver Curry and Helena Cronin for their useful comments on an earlier draft of this paper.