

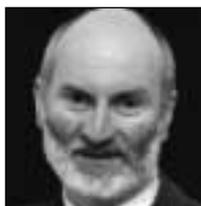
Evolving theories of behaviour

OVER a relatively short period of time evolutionary psychology has become a prominent way of understanding the human mind and behaviour. Its origins lie in a number of theoretical analyses of animal behaviour in the 1960s and early 1970s which transformed the way this subject was studied and understood. Just as the evolutionary approach led ethologists away from concentrating on the immediate causal mechanisms controlling animal behaviour, so evolutionary psychology seeks to lead conventional psychologists away from explanations that concentrate only on immediate mechanisms and mental events. Instead it offers a single unifying starting point for understanding why we think and behave as we do today: natural selection has made us this way.

This simple statement hides a number of complexities that need to be understood before the powerful insight can be translated into an effective research agenda. In this article I deal with two of these complexities that often lead to misunderstandings both within and outside the evolutionary perspective. They are, first, how specific evolutionary hypotheses are derived from broader evolutionary principles, and second, the limitations of the assumption that human behaviour is adaptive in an evolutionary sense.

Origins and mechanisms

One common dismissive view of evolutionary psychology is that it represents a series of just-so stories based on imaginary scenarios of Stone Age life. This is a misconception, but it is one that is based on the self-evident truth that we cannot know the precise circumstances under which the human species evolved, or the social organisation of early hominids. Instead informed speculations are based on various types of indirect evidence, notably broad evolutionary principles, cross-species comparisons, cross-cultural surveys, and present-day human behaviour. These informed speculations about origins can



JOHN ARCHER describes a rich research agenda for evolutionary psychology in testing novel hypotheses.

often provide new ways of viewing existing phenomena, and therefore aid overall understanding of psychological phenomena, but the speculations themselves may be difficult to test empirically.

These considerations apply to one strand of evolutionary thinking, that concerned with the origins of present-day behaviour, and its original adaptive significance. Consideration of adaptive significance is (as the pioneering ethologist Niko Tinbergen (1963) pointed out) a different type of explanation from that involving immediate causal mechanisms, which is the concern of most psychologists, whether traditional or evolutionary.

Evolutionary psychologists tend to combine evolutionary biology's emphasis on ultimate or functional explanations, with psychology's emphasis on the immediate causes of human behaviour. The way the two are linked is expressed in phrases such as 'the past explains the present' (Tooby & Cosmides, 1990, p.375), or 'we are walking archives of ancestral wisdom' (Cronin, 1991, p.3). The connection is also seen in the principle referred to as 'reverse engineering' of a particular trait or disposition (Pinker, 1997) – using present-day construction to reveal the adaptive significance.

By viewing present-day mechanisms as reflections of past adaptations, novel ways of looking at human behaviour are generated, along with testable hypotheses about present-day dispositions and the mechanisms controlling them. Just as the scope of social scientific inquiry is constrained by its sociopolitical context, so too is it constrained by the ideas that are generated by the shared assumptions in the

discipline at the time. Conventional social psychology assumes that human behaviour can be explained in terms of culture-specific social learning, with relatively little contribution from evolved dispositions to act in particular ways. In contrast, evolutionary psychology involves thinking about human beings in ways that generate novel testable hypotheses that would have been beyond the scope of conventional social science thinking (provocatively referred to as the SSSM or standard social science model by Tooby & Cosmides, 1992).

There would have been no reason for a conventional social psychologist working within the SSSM to have thought that stepchildren should be at any greater risk than natural children for child abuse or homicide; that the relatives of new-borns should comment disproportionately on the infant's resemblance to the father rather than the mother; that a man's degree of bodily symmetry would have any impact on his sexual attractiveness; that human sexual psychology is influenced by sperm competition; and that the ratio of the length of the second and fourth digit is related to musical ability. But these are among the often counter-intuitive hypotheses that have been generated by an evolutionary approach to human social life.

There are, therefore, two major contributions of the evolutionary approach. It provides informed speculations about the evolutionary origins of human behaviour, and generates novel testable hypotheses about current psychological mechanisms. Although the first is useful for an overall understanding of psychological phenomena, it is the second that is important for establishing evolutionary psychology as a research-based discipline.

A hierarchy of hypotheses

Critics of the evolutionary psychology programme often confuse what is being tested in empirical studies. Particular data sets are viewed as supporting or refuting the 'evolutionary approach'. They do not. They support specific hypotheses drawn from evolutionary or non-evolutionary views of human behaviour.

This important distinction can be clarified in relation to the notion of a hierarchy of levels of analysis involved in evolutionary hypothesis testing (Buss, 1990). At the top is the principle of natural selection, which informs the whole of modern evolutionary thinking. This is not being tested in specific studies, since it is well-established as a mechanism for the generation of adaptive changes over time, and can only be assessed by considering a wide range of biological and geological evidence that has accumulated over the last two centuries.

The next level down in the hierarchy consists of broad principles governing the evolution of social behaviour, such as kin selection (Hamilton, 1964), reciprocal altruism (Trivers, 1971), and the parental investment theory of sexual selection (Trivers, 1972). So it is proposed that behaviour can be governed by a need to help relatives and those who have given help, and mates are chosen on the basis of the effort they will put into bringing up offspring. Again, these broad principles are not being tested in individual studies since the evidence supporting them comes from a wide range of comparative studies of animal behaviour, so that data derived from a single species such as our own would be too narrow in scope.

How these second-level principles operate in different species of animal or under different environmental conditions requires us to take into account further, more specific, influences. For example, since human beings have a long gestation period within the female's body, internal fertilisation, and poor infant survival without the efforts of two parents, these considerations can be used to generate specific – or third level – hypotheses about what to expect under these conditions. One influential inference is that this will lead to male sexual jealousy and proprietary controlling tendencies by men to their female partners (e.g. Daly & Wilson, 1988; Buss *et al.*, 1992). However, this is not the only inference that could be made from the reproductive circumstances applying to humans (Hazan & Diamond, 2000; Miller & Fishkin, 1997).

Buss did not explain his fourth- or lowest-level hypotheses in any detail, but from the example in his diagram they would appear to apply to even more specific circumstances, and to involve further additional assumptions to those of the third level. An example provided by Buss was that women have evolved preferences for men who are high in status. This is not a hypothesis that is directly derived from Trivers's parental investment theory, as is the impact of paternity uncertainty on male sexual jealousy. Instead it is derived from the principle that where males are likely to contribute resources and time to child rearing, females should choose those males that show signs of being able to do so. Buss has translated this general principle into a specific hypothesis applying to the human case, which is that women should be attracted to men with money and status. That many women are so attracted is not disputed, but whether this is a consequence of evolved adaptations, or a pragmatic decision in societies where men control access to resources, is a matter of dispute (e.g. Buss, 1989; Eagly & Wood, 1999; Hrdy, 1997).

The important point about this debate is that if the consensus of the evidence does support the alternative non-evolutionary explanation, this will have falsified one particular lower-level evolutionarily-derived hypothesis, rather than the higher-level principle it originated from.

Implications

One implication of this hierarchical view of evolutionarily derived hypotheses is that evolutionary psychology can serve several purposes. At the level of the higher-order hypotheses it can tell us in a general way what we should expect human behaviour to be like if it were indeed the product of natural selection, and if general principles such as kin selection, sexual selection and reciprocal altruism do apply to our species. Many of the broad generalisations about human behaviour that we take for granted are in line with these principles; for example the importance of kin in human social interactions, age and sex differences in violence, the importance of reciprocity in social interactions between unrelated individuals, and the link between sexual attractiveness, reproductive capacity and health.

We would not therefore expect to find a human society where people helped unrelated individuals in preference to close kin, where old, sick people were found to be more attractive than younger healthy

ones, or where it was older females who committed most violent acts. We would not expect men and women to be equally discriminating or indiscriminate about their choice of a sexual partner. All of these could in principle occur if human behaviour had been shaped only by the dictates of cultural and historical forces. But such behaviour is rarely – if ever – observed even at the individual level.

We note the saintly and other-worldly character of people of a religious calling who turn their backs on both their families of origin and their future marriage prospects. The idea of gangs of elderly female delinquents only exists in the bizarre minds of *Monty Python* scriptwriters. The reality is that we can derive a fairly detailed picture about what to expect of the social life of humans from the knowledge that we are mammals that have evolved through the process of natural selection (Brown, 1991).

Most of the research agenda of evolutionary psychology involves levels of theorising and hypothesis generation that are removed in some way from these general principles. They involve additional assumptions, and can be regarded as third- or fourth-level evolutionary hypotheses in Buss's scheme. I have already referred to two examples, male sexual jealousy and women's preference for high-status men, which involve applying general principles derived from sexual selection theory to specific circumstances that (particularly in the second example) entail a number of other considerations and assumptions.

To explain what is being tested in such cases we can consider the example of internal fertilisation leading to paternity uncertainty. When associated with paternal care, this should lead to adaptations to maximise the males' chances of caring for their own offspring rather than those of unrelated males. It is important to recognise that this is a general principle, derived from the principle of sexual selection (Trivers, 1972). It does not inform us about the specific forms these adaptations will take, only that we should expect to find some. Thus any particular test of a suggested adaptation for making paternity certain will not disprove the overall principle were it to yield null results. If there were, for example, tests of five such possible adaptations that all produced null results, we would have grounds for beginning to doubt the validity of the overall principle. We would have to look again at the extent to which modern sexual selection theory (from which the principle was derived) applied to the

human case.

In practice several mechanisms for aiding paternity certainty have been suggested, in particular that men become more upset by the thought of sexual infidelity in the absence of emotional infidelity whereas women are more upset by the thought of emotional infidelity in the absence of sexual infidelity, and that men show controlling behaviour towards their mates to a greater degree than do women. These two mechanisms have been investigated in a number of studies that have generally produced evidence for their existence (e.g. Buunk *et al.*, 1996; Regalski & Gaulin, 1993; Weiderman & Kendall, 1999).

This example indicates that although the broad functional principle is clear, the precise mechanism through which it operates is not necessarily so, and has to be investigated by setting up and testing more specific hypotheses. A second example can further illustrate this point. A broad evolutionary principle is that sexual attraction should have evolved to preferentially discriminate those individuals with qualities that enable better chances of surviving and reproducing copies of their genes. The mechanisms that operate to produce such ends will again be varied, and several researchers have suggested specific hypotheses. Singh (1995) argued that the important cue that indicates a person's reproductive condition and health is their waist-to-hip ratio, and that this is a particularly potent cue for male attraction to women. Several researchers (e.g. Gangestad & Thornhill, 1997; Manning, 1995; Thornhill & Gangestad, 1999) have investigated bodily symmetry, and argued that it indicates developmental stability (arising from a phenotype that will withstand environmental disruptions and stresses during development). Consequently it will act as a marker for 'good genes' in a prospective mate.

Again, the reasoning here involves hypotheses concerning the sorts of mechanism that will effectively undertake the tasks that an evolutionary principle has identified as needing doing. However, it is always possible that these particular hypotheses are not the right ones. Singh could be mistaken in believing that waist-to-hip ratio is the universal feature that signifies good reproductive health. Male attraction to it could be, as the findings of Yu and Shepard (1998) suggest, a culturally learned response. Alternatively, symmetry could be linked with some other feature related to attractiveness. But as more and more research supports both Singh's hypothesis and the links between

bodily symmetry and traits associated with fitness, the alternatives become less likely. However, the bottom line is that even if the bulk of the evidence were inconsistent with the predictions, we would only be eliminating hypotheses about specific proximal cues, not the underlying evolutionary principle that a healthy genotype and attractiveness are linked.

These examples illustrate the nature of research hypotheses in evolutionary psychology: they are concerned with the type of psychological mechanisms that might underlie certain evolutionary principles, rather than being tests of the principles themselves. This does not diminish the value of evolutionary hypotheses, which have generated a large amount of research from a different vantage point than that of conventional psychology. It does, however, highlight a fundamental misconception about evolutionary psychological research, that in each case 'the evolutionary view' is being tested. Rather it is a specific hypothesis derived from evolutionary principles, but which almost certainly involves a number of additional (lower-level) assumptions.

Adaptation, non-adaptation and maladaptation

Does a Darwinian framework mean that all human behaviour is adaptive? In the examples considered so far, the assumption was made that we were considering features that were (and are still) adaptive for the individuals concerned, that they would have conferred survival and reproductive advantages. This is certainly appropriate where we are considering aspects of social behaviour associated with sexual selection, since the characteristics of the environment for which they are adapted (i.e. other people) have changed little since early hominid times. But if we take a wider look at human behaviour, it is clear that there are important aspects that convey no fitness advantages in the modern world. This applies particularly – but not exclusively – to behaviour viewed as pathological (Gilbert, 1998).

Some maladaptive human reactions can clearly be identified as having had fitness advantages throughout evolutionary history. A 'sweet tooth' is adaptive when sugar is relatively rare, but not in present conditions when sweet foods are constantly available. The fight-and-flight response is adaptive for responding actively to predators, but not when trapped in a traffic jam. Yet it is not only the human environment that can change at such a pace that adaptations

appear to be out of place. Predators and prey, and parasites and hosts, are in a constant evolutionary arms race. One will often be ahead of the other, thus rendering the other's adaptations obsolete. A reed warbler's parenting response to a cuckoo chick is maladaptive, yet it occurs despite selection pressures for the parent to recognise the parasitic eggs and throw them out of the nest. Its parenting response has not been refined by natural selection to take account of the current environment, one that contains the social parasite. There is evidence that heavier selection pressure over longer time periods does result in more discrimination in the parenting response (Davies & Brooke, 1988).

In the human case the difference between the African savannah where our species spent its formative years and the present-day Western world is enormous. Gone are the immediate threats to survival posed by predators, food shortage, infectious disease and extremes of temperature. Indeed our hominid ancestors would hardly recognise today's environment as the same planet. When each of us enters the modern world we bring with us bodies and brains adapted to solving problems encountered in another way of life. The short time during which humans have transformed their environment has been too short for new patterns of behaviour better fitted for the modern world to have evolved. Thus many current non-adaptive responses can be viewed in the context of the modern transformation of the human environment.

Consider the case of physical aggression between young men. It is widely recognised that as a consequence of sexual selection, fighting in the animal world is more common and has more damaging consequences among males in breeding condition than among other age and sex categories (Darwin, 1871; Trivers, 1972). This is also the case for the human species. But several features have combined in some modern environments to make physical aggression between young men potentially even more dangerous and maladaptive to those concerned. These features include alcohol and guns. In different ways they bypass the evolved rules that apply to animal conflicts (Archer, 1988, 1994; Archer & Huntingford, 1994).

Animals engage in an escalating series of threat displays before deciding whether to attack or retreat from a potential opponent. In doing so they are assessing the other's fighting ability relative to their own, and this will guide their decision whether to pursue the conflict. This is a strategy of

self-interest, of not picking a fight when the signs are that it will be lost, which is particularly important for animals with dangerous weapons. Fights between red deer stags provide a good example (Clutton-Brock *et al.*, 1982). They first use the opponent's size to assess fighting ability. If there is no obvious difference in size, the protagonists roar, which is a more sensitive indicator of fighting ability. If this does not settle the dispute by one withdrawing, they move to a parallel walk, in which contact with the antlers is invited. Even when contact begins, the animals push with their antlers rather than using the more dangerous points to stab the other.

Men do not possess dangerous natural weapons such as antlers, or even the canine teeth found in chimpanzees. There has therefore been less selection for elaborate and cautious build-ups to physical fights. Nevertheless, it is clear from studies of bar-room fights that men do appraise one another prior to engaging in physical aggression (Benson & Archer, 2001; Graham & Wells, 2000). One of the several influences of alcohol seems to be to cause people to overestimate their own abilities relative to those of opponents, and therefore enter into fights with opponents who are likely to beat them (Archer, 1994; Benson & Archer, 2001).

Guns have been referred to as the great equaliser. Their use obviously bypasses any appraisal of the other's fighting ability, so that evolved rules count for nothing. A man can lose a fist-fight, leave the scene of the fight, and return with a gun to shoot the winner. This is precisely the scenario behind many cases of male on male homicide in contemporary United States (Daly & Wilson, 1988).

The example of assessment of fighting ability shows how two features of the contemporary human environment, drinking alcohol and possessing firearms, have bypassed rules and signals that have evolved consistently throughout the animal kingdom. Alcohol causes individuals to overestimate their fighting ability and firearms render any assessment worthless. This is an interesting example in which an evolutionary approach, based on the study of animal fighting, can serve to illuminate the human case yet falls short of a complete analysis, which has to take account of the impact of the changed environment, of culture and technology, on evolved behaviour.

In contrast to this example there are some aspects of human behaviour that have never been adaptive, whether on the African savannah or under modern urban

conditions. We can look to several general principles to understand why non-adaptive or maladaptive features may result from natural selection. These include the restricted starting points natural selection has to operate on, trade-offs between competing demands, and the incorporation into mechanisms of simple 'rules of thumb' that are effective under most but not all circumstances. I will now look at examples of these principles in turn.

Considering the first of these principles, natural selection operates on an already formed organism. This situation leads to considerable restrictions and compromises in what is possible, producing many design flaws. Human anatomy provides several examples, such as the crossing over of the digestive and respiratory tracts, resulting in the dangers of choking, and the design of the human spine, which is not best suited for bipedalism (Gilbert, 1998).

Grief provides an example of the trade-off between adaptive and maladaptive features. This series of emotional, mental and behavioural reactions to loss is associated with a number of features that can lead to physical ill health and behaviour that would compromise the survival and reproductive prospects of the individual (Archer, 1999, 2000). Since grief occurs in all known human societies, and in other social mammals and birds, it would seem to be a process that has resulted from natural selection. How this occurred in spite of its non-adaptive features represents a further challenge for evolutionary psychologists.

Some have responded to this challenge by seeking to find ways in which it might prove adaptive despite first appearances; for example that it evokes help or sympathy (e.g. Crawford, 1989; Izard, 1991), or that it provides a signal to the individual to change its behaviour (Nesse, 2000).

Following Bowlby (1980), and Parkes (1972), I suggested that the maladaptive features of grief represent trade-offs with adaptive mechanisms for ensuring the persistence of important social bonds despite separations (Archer, 1999, 2000). For this to happen there must be stable internal representations of significant others that are continually checked with the outside world. These produce relationships that endure even when the other is not there, and that motivate separation reactions. The stability of the representations, the widespread occurrence of separation reactions compared with death, and the relative recency in human evolution of the understanding of death,

have combined to produce a set of reactions to the death of loved-one which are not in themselves adaptive. However, they represent a trade-off with the wider functional utility of attachment and separation mechanisms.

Ethologists are used to finding examples of simple mechanisms that operate well enough in the conditions under which the animal usually finds itself, but which can easily form maladaptive responses under other conditions. Such responses, which operate on the basis of a simple 'rule of thumb', are generally associated with animals possessing simple nervous systems. The occurrence of 'social releasers' – stereotyped reactions to simple sets of stimuli in the social world – serve well enough to ensure that animals show aggressive, sexual and parenting reactions under the appropriate conditions most of the time. They enable ethologists to trick the animal into making the same response to inappropriate circumstances in experimental situations – for example, a male stickleback will attack models placed in its territory as long as they possess a red underside, even though otherwise they look unlike a real fish (Tinbergen, 1948, 1951). But social releasers also enable other species to practise similar 'deception', as in the case of the reed warbler's response to cuckoo chicks referred to above.

Although human behaviour is usually considered to operate on the basis of far more sophisticated decision processes than these, this is not always the case. Lorenz (1950/1971) applied the concept of social releasers to human parenting responses, noting that a set of features common to the young of most bird and mammal species form a common basis for the human parenting responses. The implications of this view, which has received support from subsequent empirical studies (Archer, 1992), is that the human response to infant features is based on a simple rule of thumb. It can therefore easily be diverted to inappropriate circumstances where the same infantile features (such as big eyes and pouchy cheeks) occur in an individual that is not a human infant, such as a stuffed toy (Hinde & Barden, 1985) or a cartoon character (Gould, 1980). These considerations can explain at least the initial attraction for many humans of dogs or cats possessing infantile features. Over time, this can lead to strong attachments to them, attachments that are maladaptive in evolutionary terms (Archer, 1997).

The three principles outlined in this section provide different ways in which

aspects of human behaviour have come to depart from the assumption that all behaviour produced by natural selection is adaptive. They provide complications for an empirical analysis of human behaviour based on evolutionary principles, but they do not necessarily limit it.

Non-adaptive aspects of human behaviour that are byproducts of other, adaptive, forms of behaviour can still provide important sources of evolutionary hypotheses, providing that they show consistent variation in relation to that adaptive feature. Thus individual differences in grief (a non-adaptive feature) vary in relation to the strength of attachment (an adaptive feature), and provide the basis for an evolutionary programme of empirical investigations into individual differences in grief (Archer, 1999, 2001). Similarly, Daly and Wilson (1988) have used individual

differences in homicide (that they view as a non-adaptive feature) as an indication of individual differences in tendencies towards escalated physical aggression (an adaptive feature). By the same reasoning, individual differences in humans' positive reactions to pets (a non-adaptive feature) should follow their individual differences in positive reactions to human babies (an adaptive feature).

Conclusions

In this article I have considered two issues with important implications for understanding the research agenda of evolutionary psychology. The first was the nature of the specific hypotheses derived from general evolutionary principles, that they always involve additional assumptions, and that they are generally concerned with

specific mechanisms or cues through which more general adaptive principles operate. The second issue concerned limitations to the assumption that current human behaviour is adaptive.

Although there are many important examples of non-adaptive or maladaptive human behaviour, this does not necessarily limit the application of evolutionary principles to these topics. Current human dispositions that are non-adaptive or maladaptive are often linked in a consistent way with adaptive responses, and can therefore be used as indirect measures of these adaptive reactions.

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References

- Archer, J. (1988). *The behavioural biology of aggression*. Cambridge and New York: Cambridge University Press.
- Archer, J. (1992). *Ethology and human development*. Hemel-Hempstead: Harvester-Wheatsheaf.
- Archer, J. (1994). Violence between men. In J. Archer (Ed.), *Male violence* (pp. 121–140). London and New York: Routledge.
- Archer, J. (1997). Why do people love their pets? *Evolution and Human Behavior*, 18, 237–259.
- Archer, J. (1999). *The nature of grief: The evolution and psychology of reactions to loss*. London and New York: Routledge.
- Archer, J. (2001). Grief from an evolutionary perspective. In M. S. Stroebe, W. Stroebe, R. O. Hansson & H. Schut (Eds.), *Handbook of bereavement research: Consequences, coping and care* (pp. 263–283). Washington, DC: APA Books.
- Archer, J., & Huntingford, F. (1994). Game theory models and escalation of animal fights. In M. Potegal & J. F. Knutson (Eds.), *The dynamics of aggression: Biological and social processes in dyads and groups* (pp. 3–31). Hillsdale, NJ: Lawrence Erlbaum.
- Benson, D. A., & Archer, J. (2001). *An ethnographic study of sources of conflict between young men in the context of the night out*. Unpublished manuscript, Department of Psychology, University of Central Lancashire.
- Bowlby, J. (1980). *Attachment and loss: Vol. 3. Loss: Sadness and depression*. London: The Hogarth Press and Institute of Psychoanalysis. (Penguin edition, 1981).
- Brown, D. E. (1991). *Human universals*. Philadelphia, PA: Temple University Press.
- Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and Brain Sciences*, 12, 1–49.
- Buss, D. M. (1990). Evolutionary social psychology: Prospects and pitfalls. *Motivation and Emotion*, 14, 265–286.
- Buss, D. M., Larsen, R. J., Westen, D., & Semmelroth, J. (1992). Sex differences in jealousy: Evolution, physiology, and psychology. *Psychological Science*, 3, 251–255.
- Buunk, B. P., Angleitner, A., Oubaid, V., & Buss, D. M. (1996). Sex differences in jealousy in evolutionary and cultural perspective. *Psychological Science*, 7, 359–363.
- Clutton-Brock, T. H., Guinness, F. E., & Albon, S. D. (1982). *Red deer: Behaviour and ecology of two sexes*. Edinburgh: Edinburgh University Press.
- Crawford, C. B. (1989). The theory of evolution: Of what value to comparative psychology? *Journal of Comparative Psychology*, 103, 4–22.
- Cronin, H. (1991). *The ant and the peacock*. Cambridge and New York: Cambridge University Press.
- Daly, M., & Wilson, M. (1988). *Homicide*. New York: Aldine de Gruyter.
- Darwin, C. (1871). *The descent of man and selection in relation to sex*. London: Murray.
- Davies, N. B., & Brooke, M. (1988). Cuckoos versus reed warblers: Adaptations and counteradaptations. *Animal Behaviour*, 36, 262–284.
- Eagly, A. H., & Wood, W. (1999). The origins of sex differences in human behavior: Evolved dispositions versus social roles. *American Psychologist*, 54, 408–423.
- Gangestad, S. V., & Thornhill, R. (1997). Human sexual selection and developmental stability. In J. A. Simpson & D. T. Kenrick (Eds.), *Evolutionary social psychology* (pp. 169–195). Mahwah, NJ: Lawrence Erlbaum.
- Gilbert, P. (1998). Evolutionary psychopathology: Why isn't the mind designed better than it is? *British Journal of Medical Psychology*, 71, 353–373.
- Gould, S. J. (1980). *The panda's thumb*. New York: W. W. Norton.
- Graham, K., & Wells, S. (2000). 'Somebody's gonna get their head kicked in tonight!' Aggression among young males in bars: A question of values? Paper presented at XIV World Meeting of the International Society for Research on Aggression, 9–14 July, Valencia, Spain.
- Hamilton, W. D. (1964). The genetical evolution of social behavior, I and II. *Journal of Theoretical Biology*, 7, 1–52.
- Hazan, C., & Diamond, L. M. (2000). The place of attachment in human mating. *Review of General Psychology*, 4, 186–204.
- Hinde, R. A., & Barden, L. A. (1985). The evolution of the teddy bear. *Animal Behaviour*, 33, 1371–1373.
- Hrdy, S. B. (1997). Raising Darwin's consciousness: Female sexuality and the prehistoric origins of patriarchy. *Human Nature*, 8, 1–49.
- Izard, C. E. (1991). *The psychology of emotions*. New York and London: Plenum.
- Lorenz, K. (1971). *Studies in animal and human behaviour: Vol. II* (R. Martin, Trans.). London: Methuen. (Original work published 1950)
- Manning, J. T. (1995). Fluctuating asymmetry and body weight in men and women: Implications for sexual selection. *Ethology and Sociobiology*, 16, 145–163.
- Miller, L. C., & Fishkin, S. A. (1997). On the dynamics of human bonding and reproductive success: Seeking windows on the adapted-for human–environment interface. In J. A. Simpson & D. T. Kenrick (Eds.), *Evolutionary social psychology* (pp. 197–235). Mahwah, NJ: Lawrence Erlbaum.
- Nesse, R. M. (2000). Is grief really maladaptive? [Review of the book *The nature of grief: The evolution and psychology of reactions to loss*]. *Evolution and Human Behaviour*, 21, 59–61.
- Parkes, C. M. (1972). *Bereavement: studies of grief in adult life*. London and New York: Tavistock.
- Pinker, S. (1997). *How the mind works*. New York and London: Allen Lane.
- Regalski, J. M., & Gaulin, S. J. C. (1993). Whom are Mexican infants said to resemble? Monitoring and fostering paternal confidence in the Yucatan. *Ethology and Sociobiology*, 14, 97–113.
- Singh, D. (1995). Female judgements of male attractiveness and desirability for relationships: Role of waist-to-hip ratio and financial status. *Journal of Personality and Social Psychology*, 69, 1089–1101.
- Thornhill, R., & Gangestad, S. V. (1999). The scent of symmetry: A human sex pheromone that signals fitness? *Evolution and Human Behavior*, 20, 175–201.
- Tinbergen, N. (1948). Social releasers and the experimental method required for their study. *Wilson Bulletin*, 60, 6–52.
- Tinbergen, N. (1951). *The study of instinct*. New York and Oxford: Oxford University Press.
- Tinbergen, N. (1963). On the aims and methods of ethology. *Zeitschrift für Tierpsychologie*, 20, 410–433.
- Tooby, J., & Cosmides, L. (1990). The past explains the present: Emotional adaptations and the structure of ancestral environments. *Ethology and Sociobiology*, 11, 375–424.
- Tooby, J., & Cosmides, L. (1992). The psychological foundations of culture. In J. H. Barkow, L. Cosmides & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the evolution of culture* (pp. 19–136). New York and Oxford: Oxford University Press.
- Trivers, R. L. (1971). The evolution of reciprocal altruism. *Quarterly Review of Biology*, 46, 35–57.
- Trivers, R. (1972). Parental investment and sexual selection. In B. B. Campbell (Ed.), *Sexual selection and the descent of man* (pp. 136–179). Chicago: Aldine.
- Weiderman, M. V., & Kendall, E. (1999). Evolution, sex, and jealousy: Investigation with a sample from Sweden. *Evolution and Human Behaviour*, 20, 121–128.
- Yu, D. V., & Shepard, G. H. (1998). Is beauty in the eye of the beholder? *Nature*, 396, 321–322.

Darwinising ourselves

ARCHER has provided an important service in laying out very clearly just what is involved in evolutionary psychology's research agenda. This is important both because every discipline should be asking what it can learn from every other discipline and because the evolutionary programme is so often – I am tempted to add, wilfully – misunderstood. I want to emphasise this in what follows, along with another important point raised by Archer: that evolutionary psychology is itself divided into a number (at least two, some say three) very different research agendas that focus on very different kinds of questions.

So, let me begin with the question of misunderstandings. Evolutionary approaches to human behaviour have repeatedly come under attack over the years, mainly because they have been interpreted as implying that human behaviour is genetically determined and so cannot be changed – or that if we can show that all the many rather nasty things we do to each other are evolved behaviours, this means that they are justified and 'good'. This argument has nothing to do with biology or evolution: *is* does not mean *ought*.

But there is another reason why this claim is nonsense, and this is that no species is so constrained in its behaviour. Such an argument would imply absolute genetic determinism in the strong sense, but most biologists would be surprised if you could demonstrate that anything above the amoeba is that genetically determined in its behaviour. The reality is that all species (but not humans, critics of the evolutionary approach would apparently lead us to believe!) are extraordinarily flexible in their behaviour. To be sure, they have species-typical limits to this flexibility (pigs really don't fly). But within those limits their behaviour is determined much more by the contingencies of the world: animals respond to the costs and benefits of the choices that face them, and we can alter their behaviour quite easily by changing the relative weightings of those costs and benefits. If this sounds like good-old familiar learning theory, you're not too far wrong!

In other words the evolutionary approach merely argues that organisms in general (humans included) are guided by goal states that are, ultimately, dictated by



Peer commentary by **ROBIN DUNBAR**.

evolutionary considerations (namely fitness, or more crudely the desire to have grandchildren). Obviously there are a number of proximate goal states that are involved (the basic drives perhaps) but these are simply essential stepping stones on the way to maximising fitness.

The simple truth is that dead men neither tell tales nor reproduce, so we can expect evolution to produce a motivational system that is designed to avoid situations that are likely to result in death. But within these general constraints, most advanced organisms (those with brains of sufficient size to do the computations) are left by evolution to figure out for themselves the best way of achieving these deep goal states according to the circumstances of the moment. It would be almost impossible to do otherwise, since the contingencies of real life (especially for long-lived species) are such that no amount of advance programming could possibly produce an organism capable of responding appropriately to every single contingency. Experience and smartness must play crucial roles.

The important conclusion here is that the evolutionary approach focuses on strategic decision making, not on genes as the determinants of behaviour. The assumption is that the goal states involved are fitness-related, and it is an empirical question how well humans (or any other species) match up to performance of the rational fitness-maximiser. On the whole, the data suggest that humans (like most other animals) are generally pretty good at it. This is not to say that some individuals don't make mistakes. Mistakes are an essential part of the evolutionary process – there would be no evolution without them. The claim is simply that organisms get it right on average, and that means some do better and others do worse.

But there is another reason why mistakes should occur – and this is that the biological world is extraordinarily

complex. We tend to do science by controlling confounding variables in order to expose the one key variable we are interested in to systematic manipulation. But in biological systems it is extremely common for one variable to be traded off against another. The classic trade-off in biology is that between parental care and litter size. I can choose (if I may be pardoned for using conventional biological terminology here) to have lots of offspring but invest nothing in them (in which case, many will die before they get to reproduce), or I can have few offspring and invest nurturingly in each (so increasing each one's chances of surviving to reproduce). (Salmon and humans are specific examples of these two strategies, by the way.) There will *always* be a point in the two-dimensional state space where the two strategies produce equal numbers of surviving offspring. This is because time (or energy) constraints invariably make it impossible to achieve both goals (of quantity and quality of offspring) at the same time in biological systems. If we focus on just one variable, we will be misled into thinking that some individuals are doing very badly.

The suggestion that organisms maximise under constraint leads us directly into the second issue, namely the fact that there are interesting evolutionary questions to be asked about the cognitive machinery that supports these kinds of decision making (at least in those cases where meaningful choices between behavioural options are being made). The kind of approach I outlined above does not concern itself with the cognitive machinery; it simply assumes that, so long as we can show that things work properly at the behavioural level, there must be something in the black box that does the relevant work. This approach tends to focus on behaviour and tries to measure behavioural outputs as indices of fitness (numbers of babies produced, how much energy or wealth is

invested in individual offspring, who leaves what to whom in their will). This tradition concentrates on what Tinbergen identified as functional (or purposeful) questions. In many ways, this approach is nothing more than social psychology in a new guise: it is concerned principally with people's relationships with each other.

But the question of what cognitive processes are involved in all this is genuinely interesting. Is the human mind designed to be sensitive to certain kinds of cues? Is the human mind designed to respond to those cues in certain kinds of ways? What constraints does the machinery of the mind impose on our decision-making flexibility? These questions require us to use the conventional cognitive psychology toolkit of carefully designed pencil-and-paper tests. These questions concern mechanistic explanations, and do

not in any way conflict with functional (or indeed developmental) questions.

It is important to appreciate that even though some evolutionary psychologists focus on one approach to the exclusion of the other, they are not mutually exclusive. Many labs that work on human evolutionary psychology (including my own) do both kinds of study with equal enthusiasm. Indeed we should view the evolutionary approach as a genuine opportunity to weld together the innumerable cracks that threaten to tear psychology as a unitary discipline apart. If you like, the evolutionary approach shows why cognitive psychologists and neuropsychologists (with their interests in mechanisms) should take social psychology (which needs a more functional orientation) seriously – and vice versa.

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Main agendas and hidden agendas

E VOLUTIONARY psychology has a growing appeal, Archer begins. As rhetoricians know, repackaging cliché as new insight threatened by conservative critics rarely fails to seduce. Are attractive young women alluring? Males randy? Step-parents wicked? Men competitive? Women nurturing? Let us generate some 'novel testable hypotheses'. Did I hear 'novel'? No, grandpa, lie back and snooze. We are busy deploying science in the service of your favourite tunes – 'Birds do it...'

Before flux and uncertainty rocked physics early last century, the dream of science was that the material world could be tracked back to its foundations, and the laws of mathematics and physics combined to produce readily falsifiable predictions. This remains evolutionary psychology's promise to a discipline long frightened of failing tests of rigorous predictability – well after many scientists accepted 'the disorder of things' (Dupré, 1993), embracing greater epistemic diversity. Archer offers 'a single unifying starting point for understanding why we think and behave as we do today: natural selection has made us this way'.

Yes, the human species evolved and has survived; but natural selection has made us what way, exactly? The search is on for universals of human behaviour. Yet, Archer admits, should we claim to find behavioural universals, this would hardly establish the validity of any conjectured evolutionary origins. He fails to add that talk of evolutionary selection is empty speculation unless psychologists offer evidence, as Darwin did, of the natural history of their presumed evolved behaviour – appearing or disappearing as adaptations to specific local conditions. They do not.

Meanwhile, off the agenda is all that is uniquely human: the starting point for anyone interested in the historical temporalities and spatial diversities of human lives, or the cultural formations in which they are lived. These could hardly be less uniform; nor more unlike those of even the great apes, with whom we share most



Peer commentary by **LYNNE SEGAL**.

of our (genetically dormant) DNA – so assiduously mapped these last two decades.

Although a seasoned critic of the conceptual confusions and quantitative fetishism of experimental psychology, I can suggest a few testable hypotheses of my own. They are not unconnected to my personal and political agenda, easy to fathom, however recently unfashionable. These hypotheses are not so novel, having already been tested in the UK. They concern the behaviour of human females in relation to issues of 'reproductive advantage'. Grandpa, wake up; I know you are worried!

The main supposed 'truth' of evolutionary psychology is that all living creatures are driven to maximise the successful reproduction of offspring, with male and females exhibiting contrasting behaviour patterns owing to their opposed (low versus high) 'parental' investments. Let's test it. Do women in Britain act in line with 'reproductive advantage'? Are women more likely to have children when they are most vigorous and fertile? Do women delay having children while waiting for men with resources? Do women with children remain with males who support their biological offspring? Here are some answers. In the UK in the 1990s, women overall delayed giving birth until their thirties. The proportion of women remaining childless increased steadily over recent decades. The number of single and lone mothers has expanded rapidly since 1970. More women cohabit and marry later; more divorce and separate (HMSO, 1995). Neo-Darwinians meet women freer to decide how they want to live (although rarely in conditions of their own choosing).

Why select evolutionary psychology as the standpoint from which to formulate

hypotheses today? Its simplicity may appeal to the media's inevitable populism (we are what our Stone Age ancestors made us), its alleged biological trappings may consummate some psychologists' dream that their discipline reduces to truths of the natural sciences ('culture is part of our biology'), but its scientific credentials have always been the object of rigorous rebuttal from authoritative critics directly engaged with the complexities of human genetics. Why are we discussing the recycling of suspect science long after its weaknesses have been repeatedly exposed? One reason is the reassurance it offers in the face of human malleability, particularly the cautionary tales it carries for the sex which has recently broken down many of the social injustices of the past: read any of Helena Cronin's pronouncements that enhancing women's financial independence is at odds with human nature (e.g. Cronin & Curry, 1996).

But there is more to it than this, especially the genetic boosterism encouraged by over-funded molecular biologists in search of human genetic blueprints. However, those wishing to do justice to Darwin himself note that for him evolution was never narrowly, or even primarily, a biological affair. It was rather a slow, heterogeneous, profoundly environmental process. 'Alas, poor Darwin', as many distinguished researchers (ranging from molecular biology to developmental psychology) lament in the latest scholarly rebuttal of evolutionary psychology (Rose & Rose, 2000). These are researchers who see their labours mocked by the pseudo-scientific posturing of evolutionary psychology, since the complexity of our evolutionary history (with its barely understood genetic unfoldings) produces no certain biological

outcomes. Talk of the biological origins of human existence neither explains any particular pattern of events nor predicts their future direction.

We can all play the correlational game of 'testable hypotheses', as in Daly and Wilson's use of 'kin selection' to 'predict' men's violence, and children's susceptibility to murder or abuse from step-parents. They cannot explain why many people adopt children, and usually take loving care of them. They cannot predict why violence against wives often begins when the woman is pregnant, cannot be impregnated by 'rival males' and carries 50 per cent of her aggressor's genes – the most home-bound and submissive wives (like foreign brides) being most at risk of murder. Similarly, Thornhill and Palmer's recently hyped 'rape-adaptation hypothesis' flies in the face of statistics on the frequency of male-on-male rape, rape without penile penetration, the sexual abuse of pre-pubescent girls and the infrequency of rape resulting in conception. Characteristically, Thornhill and Palmer

offer no data to suggest that the genes of men who rape have been selected for over men who do not, nor to support their calls for more modest dress in women.

I could go on supplying this kind of critique. The main point is that evolutionary psychology's unifying presumptions bear no relation to growing genetic knowledge – which all suggests the unpredictable complexities in human genetic transactions. Trying to understand even rare genetically 'simple' diseases, like haemophilia, proves hugely complicated. What millions of years of genetic change have actually produced is the potential for human cultural invention. It is ironic if, in the name of science, psychologists merely find new ways of recycling old forms of reductionism.

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References

- Dupré, J. (1993). *The disorder of things*. Cambridge, MA: Harvard University Press.
- Cronin, H., & Curry, O. (1996). What next? 10 big challenges from the evolutionary agenda. In J. Ashworth, H. Cronin & O. Curry (Eds.), *Matters of life and death: The world view from evolutionary psychology*. Demos Quarterly no. 10. London: Demos.
- HMSO (1995). *Social focus on women*. London: HMSO.
- Rose, H. & Rose, S. (Eds.). (2000). *Alas poor Darwin: Arguments against evolutionary psychology*. London: Jonathan Cape.
- Thornhill, R., & Palmer, C. (2000). *The natural history of rape: Biological bases of sexual coercion*. Cambridge, MA: MIT Press.

The design of the human mind

THE central goal of psychology is to understand the complex design of the human mind. Evolutionary psychology is founded on the premise that conceptual tools emerging from modern evolutionary theory can aid in this noble quest. That humans have evolved is uncontroversial. That humans owe the design of their bodies to evolutionary processes is uncontroversial. That the 1400 cubic centimetre brain and its functional mechanisms have evolved is uncontroversial. What remains contentious, and legitimately so, is precisely how evolutionary processes have sculpted the psychological mechanisms housed in that large brain.

Among scientists who have grappled with evolution and human behaviour there is disagreement about the relative importance of various evolutionary processes such as natural selection, sexual selection, and genetic drift (Dawkins, 1982; Gould, 1991). There is also disagreement about the centrality of adaptations as opposed to by-products of adaptations (sometimes called 'exaptations'; see Buss *et al.*, 1998; Gould, 1991; Pinker, 1997). But there are no known scientific alternatives to the premise that evolutionary processes are responsible for creating human psychological mechanisms, whatever their nature turns out to be. Evolutionary psychology differs from most perspectives in psychology by attempting to confront this premise explicitly.

Archer highlights two ways in which evolutionary thinking can aid the understanding of human behaviour – as a way of informing theories of human origins and as a means of generating novel hypotheses about evolved psychological mechanisms. Contributions of this type are worthy, although they are often met with strident rejection and unseemly attacks on the motivation and character of scientists who propose them. However, there is no reason to summarily jettison an important source of novel hypotheses about the human mind. If the proponents fail to formulate the hypotheses in a precise and testable manner, or if the derived



Peer commentary by **DAVID M. BUSS.**

predictions derived fail to be supported empirically, then the hypotheses can be rejected on scientific grounds alone, as some have; if they are formulated precisely and confirmed empirically, then they can be accepted on scientific grounds alone, as some have (Buss, 1999).

This article highlights an often overlooked dimension of evolutionary psychology – its heuristic value in guiding researchers to important domains of inquiry that have been ignored by more traditional approaches to psychological science. One scientist captured this contribution as follows: Darwinism merely 'provides a guide and prevents certain kinds of errors, raises suspicions of certain explanations or observations, suggests certain lines of research to be followed, and provides a sound criterion for recognizing significant observations on natural phenomena' (Lloyd, 1979, p.18).

One realm of human behaviour entirely overlooked before evolutionary psychologists came along was the domain of 'mate guarding' (Buss, 2000). The theory of sexual selection (Darwin, 1871) has guided researchers to the centrality of same-sex competition or intra-sexual rivalry in the mating arena. In sexually reproducing species, members of each sex are in competition with members of their own sex for mating opportunities. Adaptations can evolve through the two component processes of sexual selection – preferential mate choice for certain qualities, and competition among members of one sex for access to the opposite sex.

To pick one example, gaining a mate does not solve the adaptive problem of retaining a mate. Since desirable mates often remain attractive to others after they are mated, people are faced with the adaptive problem of 'mate poaching' from

same-sex rivals (Schmitt & Buss, in press). People are also faced with the problem that their mates might find other partners who are more desirable, and hence be tempted to have an affair or to leave the relationship. Given the magnitude of investment that people expend on selecting and attracting mates, it would be astonishing if selection failed to fashion psychological mechanisms designed to prevent rivals from poaching and mates from defecting (Buss, 2000).

Evolutionary biologists have discovered an extraordinary array of mate-guarding mechanisms among male insects and animals. These range from sequestering the female, remaining physically attached to the female after copulation, emitting scents to counteract the attractant signals of the female, reducing the conspicuousness of the courtship display, physically repelling other males, building a fence around the female, and inserting a mating plug in the female reproductive tract (Thornhill & Alcock, 1983). Traditional psychologists, however, had never thought to examine mate guarding in humans. No mainstream psychological theories had guided researchers to this potentially important domain of inquiry.

Once exploration began, guided by evolutionary thinking, many fascinating phenomena were discovered. Nineteen distinct human mate-guarding tactics have been documented, ranging from vigilance to violence (Buss, 2000). Researchers discovered that women and men alike guard their mates, but they use somewhat different tactics in doing so. Men are more likely than women to attempt to conceal their mates, display resources to prevent their mates from leaving, threaten rivals verbally as well as nonverbally (e.g. the cold primate stare), and physically attack

rivals who attempt to encroach on their mates. Contrary to stereotypes, men are also more likely to display submission and self-abasement in the service of mate retention, for example promising to change or going along with everything the mate requests. Women are more likely than men to repel rivals by publicly displaying commitment. The statements 'I told the other women how much we were in love' and 'I wore his clothes in front of others' illustrate this tactic. Women also take greater pains to enhance their physical attractiveness in the service of mate retention.

Researchers have also discovered a key set of circumstances that predict the amount of effort a person will devote to solving the adaptive problem of mate guarding (Buss, 2000). The most important predictors of men's mate-guarding effort are the perceived probability that the partner will kiss, date or have sex with other men; the mate's physical attractiveness; and the magnitude of age disparity between the members of the couple. The strongest predictors of women's mate retention efforts are the husband's income and the amount of effort the husband devotes to getting ahead in the status hierarchy (Buss & Shackelford, 1997). Some of these findings are intuitively obvious, others not so obvious (e.g. men's use of submission in mate retention).

The key point is that conceptual tools drawn from evolutionary theory have served an important heuristic function for psychologists. They have guided researchers to domains previously neglected by more mainstream psychologists, such as the domain of human mate guarding. They have informed the articulation of hypotheses in this domain. And they have led to the discovery of important phenomena that were previously unknown in the psychological literature.

Evolutionary perspectives on human behaviour have generated outrage and debate ever since Darwin articulated his theory of natural selection in 1859. A contemporary of Darwin was reputed to have said: 'Let's hope that it's not true; but if it is true, let's hope that it doesn't become widely known.' There is no reason

to believe that strong reactions will subside. Hopefully, the debate can be elevated to a rational examination of merits on scientific grounds rather than shrill rejection on emotional grounds. The science of psychology can ill afford to discard a theoretical perspective that has proved its worth among thousands of non-human species. There is no reason to believe that humans are magically exempt from the causal processes that have shaped all forms of life. Evolutionary psychology provides conceptual tools for helping with the complex endeavour of discovering the design of the human mind.

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References

- Buss, D. M. (1999). *Evolutionary psychology: The new science of the mind*. New York: Oxford University Press.
- Buss, D. M. (2000). *The dangerous passion: Why jealousy is as necessary as love and sex*. London: Bloomsbury.
- Buss, D. M., Haselton, M., Shackelford, T. K., Bleske, A., & Wakefield, J. (1998). Adaptations, exaptations, and spandrels. *American Psychologist*, 53, 533–548.
- Buss, D. M., & Shackelford, T. K. (1997). From vigilance to violence: Mate retention tactics in married couples. *Journal of Personality and Social Psychology*, 72, 346–361.
- Darwin, C. (1871). *The descent of man and selection in relation to sex*. London: Murray.
- Dawkins, R. (1982). *The extended phenotype*. San Francisco: W. H. Freeman.
- Gould, S. J. (1991). Exaptation: A crucial tool for evolutionary psychology. *Journal of Social Issues*, 47, 43–65.
- Lloyd, J. E. (1979). Mating behaviour and natural selection. *The Florida Entomologist*, 62, 17–34.
- Pinker, S. (1997). Evolutionary psychology: An exchange. *New York Review of Books*, XLIV, 55–56.
- Schmitt, D. P., & Buss, D. M. (in press). Human mate poaching. *Journal of Personality and Social Psychology*.
- Thornhill, R., & Alcock, J. (1983). *The evolution of insect mating systems*. Cambridge, MA: Harvard University Press.

Behaviour – Adapted? Adaptive? Useful?

ARCHER'S clear account of the feasibility and necessity of testing evolutionary psychological hypotheses follows in the footsteps of a series of articles making the same point, the most recent being Ketelaar and Ellis (2000). It seems to need constant repeating that *all* hypotheses, from whatever theoretical position they are derived, are no more than 'just-so' stories until they are subjected to empirical test. Hypotheses concerning the mental algorithms used by humans to solve longstanding adaptive problems are no exception.

A reasonable hypothesis – given the advantages of biparental care and the fact that internal fertilisation creates paternity uncertainty – would be that men should have evolved the ability to detect ovulation in women. But they clearly have not. This suggests that the problem of paternal uncertainty has been solved in some other way, and Archer offers a number of empirically supported solutions. Candidates for human adaptations are identifiable by their species typicality, evidence of special design, untutored emergence, resistance to modification and ancestral fitness benefits. The challenge for evolutionary psychologists is not merely to locate them but to specify how these modules operate – what inputs they accept and what contingent outputs they generate. It is unfortunate that psychology's preoccupation with proximal mechanisms (the *how* question, which evolutionary psychologists also address) has created a climate where consideration of the ancillary question of origins and functions (the *why* question) is viewed with suspicion.

But the *why* question is central since it distinguishes evolutionary hypotheses about adaptations from alternative explanations that view the origins of human behaviour as culturally acquired and nearly infinitely malleable. When we reach the lowest level of Buss's hierarchy – the derivation and testing of specific predictions about the form that adapted solutions to recurrent evolutionary problems might take among humans – we



Peer commentary by **ANNE CAMPBELL**.

arrive at the place where the real academic debates occur. An evolutionary prediction, for example that men should everywhere and at all times show higher levels of intra-sexual aggression than women (as a function of their greater fitness variance), is often appropriated by alternative non-evolutionary positions and argued to flow from culturally acquired gender roles. Such theorists accept that evolution has been responsible for a human ability to acquire culture, but not for its contents.

But these 'proximal' accounts evade the questions of why such gender-bound patterns in aggression occur across all cultures so far examined; why they are evident across a wide variety of measures; why they manifest themselves prior to acquisition of gender identity and are not a function of differential parental socialisation; why they peak at precisely the age when men are most preoccupied with sexual access to females; why they continue to be as apparent in both self ratings and gender stereotypes today as in the 1950s despite massive changes in roles; and why they are visible in all other species with greater female parental investment and are modulated by early androgen exposure (Campbell, *in press*).

I would like to expand on Archer's discussion of constraints on optimal adaptations (see Buss *et al.*, 1998). He discusses three in detail: forced design moves (blood vessels running across the surface of the retina would be considered a classic example of poor design if an engineer was starting from scratch); trade-offs between different systems that leave us with design flaws (the pain and danger of human childbirth resulting from the intense pressure toward bipedalism); and adaptive systems that can misfire (e.g. Disney's exploitation of our response to neonatal

features).

Other reasons why adaptations appear less-than-perfectly tailored to their problem-solving role include the lag time between adaptive problems and solutions (we are more prone to snake phobia than gun phobia despite the latter's far more common and lethal quality), local optima (where a better adaptation may exist but cannot be reached from our current state without temporarily and catastrophically sacrificing fitness), lack of sufficient genetic variability on which selection can work (X-ray vision could well be advantageous but no human possesses even the rudimentary capability of extending their spectral sensitivity this far) and costs that we would be happier without (testosterone effectively matures the male sexual system but compromises the immune system leading to earlier male senescence and death, which, because it occurs post-reproductively, escapes selective elimination).

The point is that adaptations do not have to be optimal – they need only generate behaviour that is better than that of our competitors. As the old joke about the two men running from the bear so aptly captures it – First man: 'You'll never outrun him'. Second man: 'I don't have to. I just have to outrun you'.

With regard to Archer's phrasing of the question 'Does a Darwinian framework mean that all human behaviour is adaptive?' it is worth noting that not even the most ardent Darwinian believes that all human behaviour represents an adaptation. Evolution, if it were the whole story, still has to reckon with the existence of by-products and random effects (Buss *et al.*, 1998). Just as light bulbs incidentally give off heat though they were designed to provide light, so the human navel is not

there to aid our survival or reproduction but is a remnant of the umbilical cord that was necessary to supply food to us as *in utero*. By-products are recognisable by their consistent link with an adaptation. But that does not mean that there is universal agreement about whether a given attribute is an adaptation or a by-product – Gould (1991) argues that the human capacity for language was a by-product of large brains, which were originally selected for some other unspecified function. In addition, natural selection does not screen out noise or random effects. These are chance fluctuations, independent of adaptations, that neither enhance nor detract from fitness. They are superficial modifications, at least from the point of view of natural selection. Take individual differences in personality – since we retain a normal distribution of extraverts and introverts there is no reason to suppose that variation on this trait is important for natural or sexual selection. If it were, the favoured value would have gone to fixation.

But human behaviour is also influenced by culture and, contrary to some critics, evolutionary theorists do not ignore this fact. Fitness-relevant aspects of culture are thought by most evolutionary psychologists to be constrained by genetic evolution (as captured in the phrase ‘Genes hold culture on a leash’). Culture is viewed as evolved individual preferences writ large, which act as a selecting environment for genotypes. Hence cultures everywhere encourage marriage (in some form), parental investment, reciprocal altruism and co-operation, but discourage theft, violence and suicide.

Culture also acts as a tool for

transmitting memes or socially acquired knowledge (e.g. specific languages and technologies) through generations in a parallel way to genetic inheritance. There is controversy about how just how tightly these memes are tied to the biological best interests of the individual, but it is clear that many fitness-irrelevant memes spread widely. Preferences for fatness or thinness, for caviar or cod, for acid house, rock or sitars all affect human behaviour but there is no assertion that they are adaptive.

It is also important to bear in mind that ‘adaptive’ is distinct in meaning from both ‘useful’ and ‘adapted’. Many currently useful behaviours are not adaptations. Literacy is a very handy tool but it is too recent a faculty for selection to have worked upon it; hence young humans require considerable tutoring to master it. However, if those individuals who find reading simple were to prove more attractive mates and so produce more offspring than others (and if the selection pressure was consistently directional and long-lasting), the ability to acquire reading swiftly could be positively selected in the future (Miller, 2000).

To say that a behaviour (or more correctly the psychological module that produced the behaviour) is adapted is to say that during human evolution it conferred fitness benefits of such significance that those individuals who possessed it systematically survived and reproduced more effectively than those who did not.

Whether or not a contemporary behaviour or mental algorithm is adaptive (i.e. will result in systematic selection in future generations) cannot be answered in

the present and depends on the stability of selection pressure over the next tens of thousands of years. These selection pressures may be very different from those that operated in the past. The effects of natural selection have been attenuated (thankfully) in many parts of the world by huge medical advances that have especially benefited the most vulnerable – premature infants, neonates and the elderly.

The effects of sexual selection have been altered recently by the demographic transition – an evolutionarily novel state in which the tie between resources and reproductive success has been broken. As far as the shape of our adapted future is concerned, we will just have to wait and let our genes find out through the eyes of our descendants.

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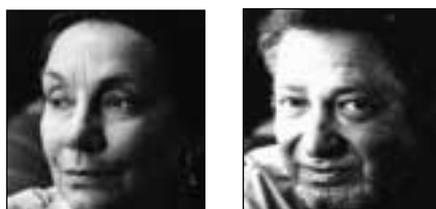
References

- Buss, D. M., Haselton, M. G., Shackelford, T. K., Bleske, A., L. & Wakefield, J. C. (1998). Adaptations, exaptations and spandrels. *American Psychologist*, 53, 533–548.
- Campbell, A. (in press). *A mind of her own: The evolutionary psychology of women*. Oxford: Oxford University Press.
- Dennett, D. C. (1995). *Darwin's dangerous idea*. New York: Simon and Schuster.
- Gould, S. J. (1991). Exaptation: A crucial tool for evolutionary psychology. *Journal of Social Issues*, 47, 43–65.
- Ketelaar, T., & Ellis, B. J. (2000). Are evolutionary explanations unfalsifiable? Evolutionary psychology and the Lakatosian philosophy of science. *Psychological Inquiry*, 11, 1–21.
- Miller, G. F. (2000). *The mating mind*. London: Heinemann.

Much ado about very little

HUMANS, like all other species, are evolved organisms, and like all other multicellular animals, have complex and lengthy routes of development to maturity. So any understanding of human psychology must properly take into account evolution and development as well as historical social and cultural contexts. So much is uncontroversial. That what now passes for evolutionary psychology (EP) has become, as Archer suggests, a 'prominent way of understanding the human mind and behaviour', fanned by a host of popular books but drawing on rather limited and often controversial research data, is clear. The question is whether it offers any useful additional explanatory or descriptive power in understanding the specificities of, as 'EPers' put it, 'why we do what we do'.

To understand the problem this presents, we need to distinguish enabling from causal mechanisms, and proximal from distal explanations. That we are both empowered and limited in our behaviours by our evolutionary history is a matter of common agreement – our psychologies and our societies and cultures are patterned by our long lifespan, the first period of which is spent in lengthy dependency on caregivers. Our sensory limitations, notably olfactory, constrain our worlds. These are non-trivial enabling distal generalisations. But they permit vast ranges of different behaviours, and are of a level of generality that makes them relatively unhelpful in most of the specific themes (generally focused around sex, violence and selfish behaviour) for which EP makes its pitch. Proximal explanations of individual behaviours will indeed include physiology and development, but will also take into account specific social contexts. That, as Archer suggests, men picking bar-room quarrels size up their opponents before fighting unless drugged or drunk or in possession of guns (those 'equalisers') is more usefully accounted for in terms of individual prior experience (youngsters



Peer commentary by **HILARY ROSE** and **STEVEN ROSE**.

fairly rapidly learn their limitations). Elaborate evolutionary speculations add nothing.

It is particularly troubling that such speculative accounts centre on the social and sexual practices of our palaeolithic ancestors (the so-called environment of evolutionary adaptation) where data is, to say the least, scanty. Archer falls into the standard EP error of claiming that 'human nature' was fixed in this period and that there has been insufficient time in the 6000 or so subsequent generations to change it – an assertion which is negated by the robust experimental and observational evidence of the rapidity with which gene-based evolutionary change can occur (for this and other elaborations of the evidence discussed in this response see Rose and Rose, 2000).

Archer's defence is to retreat into references to unspecified 'broad evolutionary principles' which enable 'informed speculations' to be made about what might be expected of human behaviour. He argues that although such principles are unfalsifiable they generate sub-hypotheses which, can be tested, although even if demonstrated to be false, would not invalidate the general approach. So his appeal, finally, is not to empirical science but to metaphysics. But are the sub-hypotheses he quotes indeed supported by the evidence?

One of the more disturbing conceptual weaknesses in evolutionary psychology, and replicated in Archer's review, is the unreflective treatment of the linked concepts of family and kinship. EP positions itself as a discourse between the life and the social sciences, yet it

reproduces a concept of family and kin which anthropologists have for almost 30 years discussed and rejected as a 'folk model'. Like Mrs Thatcher's attacks on gay and lesbian unions as 'pretend' families, the folk model knows already the 'real' family as an enduring biologically based relation of solidarity. Thus within EP the biological account of family is given priority over the social. Even while small children say that their pet dog is part of their family, or gay partners fight to secure legal recognition, or we read the reasoning through which judges decide contestations of parenthood for infants born using IVF techniques, where the meanings of 'to father' and 'to mother' spiral into complexity, the mythic 'real' family constantly seeks to assert itself. Unquestionably, in everyday life this folk model has huge power and jostles alongside the other multiple concepts of family in cultural contestation. However, the task of science is to unpick the complexity, not reproduce folk models.

In deriving universal behavioural propositions, no ethologist would ignore the specificities of each individual species in terms of its sexual and offspring-rearing practices. The sexual practices of scorpionflies are not projected on to peahens and peacocks, but this changes when EP turns its attention to the human animal. Here little respect is paid to the empirical studies of social anthropologists, sociologists, or for that matter developmental neuroscientists. Instead the sexual, infanticidal, coy practices of other, arbitrarily selected, species are projected *ad lib.* on to humans. The extreme plasticity of human behaviour – itself a

product of human evolution – is set aside.

When evolutionary psychologists draw inferences from animal behaviour studies to human behaviour, they also neglect fundamental differences. To take an example Archer does not discuss Thornhill and Palmer's (2000) account of rape. In the scorpionflies Thornhill studied he was able to specify the negative environmental conditions under which all males forced sex on (in his heightened anthropomorphic language 'raped') female scorpionflies. This, Thornhill argues, is evolutionarily adaptive behaviour. So far so good; careful, well-designed studies. Had he followed the changing practice of his profession during the 1980s and changed the anthropomorphic language of 'rape' to that of 'forced sex', his audience would probably have remained among the professional journal readers. However, he is both unwilling to give up on the term, and is deeply committed to making the human link, however inappropriate.

Thus, when Thornhill and Palmer turn to rape among human beings some extraordinary contortions are necessary to place it within an evolutionarily adaptive framework. First the concept of rape has to be delimited, removing all the forms that cannot result in reproduction (e.g. anal rape). In one move such victims of rape are silenced, their pain is discounted. Instead the biologists assure us that the suffering of raped fertile-age women is the greatest. Rape victims, who not infrequently describe the subsequent court hearings as

a second rape, might well see the Thornhill and Palmer book as a third. They treat rape victims as on the same ontological level as scorpionflies, to the biologists such victims are just objects of research not human subjects active in the understanding of their own lives. Given that this book has to be the nadir of EP literature, it would have been nice to see Archer disassociate himself from it explicitly.

The example he does draw on is that of Daly and Wilson, and here it is troubling to find a psychologist of Archer's status tolerating such casual biological constructions of family relationships. There has long been compelling Euro-American evidence that when a non-biologically related man lives with a woman and her children the incidence of sexual abuse and violence is likely to be greater than where the biological father lives with them. However, Daly and Wilson's commitment to the bio-folk model of a 'real' family, leads them to categorise all such men as 'stepfathers'. Empirically this is ludicrous. Imagine asking a child from such a household 'Is that man your dad?' What might Daly and Wilson do with replies such as 'No he's my mum's boyfriend, my dad lives two blocks away' or 'No he's just my mum's current boy friend, I haven't got a dad' or even 'Well he and my mum try to pretend he is, but I don't like him'. Daly and Wilson clearly do not listen to what children say in all its complexity, and are thus free to impose the category of stepfather (regardless of his emotional

commitments or non-commitments) on to any live-in lover, thus shoring up their distal thesis of genetic love.

It is important not to duck the ethical implications of Daly and Wilson's thesis, for their approach requires that the voices of victims are silenced. For that matter they fail to explain the counter-evidence that adoptive parents do rather better on the violence and abuse stakes than biological parents. The proximal explanation that the social commitment of these would-be parents is what counts and not genetic love is ruled out by the Darwinian credo. Yet again the horse of evolutionary speculation has got the explanatory bit between its teeth and shows no sign of being reined in by either conflicting evidence or conceptual criticism.

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References

- Rose, H., & Rose, S. (Eds.). (2000). *Alas poor Darwin: Arguments against evolutionary psychology*. Cape.
 Thornhill, R., & Palmer, C. T. (2000). *A natural history of rape: Biological bases of sexual coercion*. MIT.

Do not adjust your beliefs, there is a fault in reality

Why do some commentators have problems with evolutionary psychology? JOHN ARCHER responds.

THREE of the commentaries are sympathetic to evolutionary psychology, the other two hostile. These opponents perceive problems with the predictions derived from evolutionary psychology. But why is the derivation of novel hypotheses so controversial?

Hypothesis testing is, after all, central to the scientific method. Who could possibly disagree with it? The answer is anyone who views scientific research as subservient to ideological beliefs. Unlike political or religious beliefs, scientific research involves a way of deciding between competing explanations. It therefore seeks to be objective, open and accountable. Yet, since science is located in the social world, it is subject to social pressures derived from political and religious beliefs. Suppression of unacceptable findings and theories have occurred throughout history, but more subtle influences operate all the time even in liberal democracies.

The research agenda is limited by commonly held beliefs. Certain topics are deemed worthy of investigation, whereas others are not, or are not entertained as possibilities. Thus investigation of women's issues was largely ignored in the early part of the 20th century, owing to an unchallenged male-centred view of the social world. An agenda informed by feminist critiques became acceptable, even fashionable, among Western psychologists from the 1970s onwards. This has enriched the subject by extending the possibilities for empirical investigation, and introducing new ways of interpreting findings.

Likewise, evolutionary psychology has raised novel possibilities about human social behaviour, for example that it may be influenced by sperm competition, or by bodily symmetry, or by bodily secretions. These would have been outside the thinking of conventional psychologists, since they are not part of a world view informed by culturally based explanations of social behaviour. However, these possibilities are only hypotheses to be tested. The issue is, therefore, whether to broaden the research agenda or to narrow

it by censoring certain possibilities before they are tested.

Of course critics of evolutionary psychology such as the Roses never use the term *ensorship*. They come nearest to admitting to this position when they object to evolutionarily based research because of its presumed implications for social policy. Attempts to discredit the scope or quality of evolutionary research, or to claim that its theoretical basis is muddled or unsound, are used as additional debating tactics.

Behind the critical commentaries by Segal and the Roses is the assumption that evolutionary psychology is inherently reactionary, and has undesirable policy implications. This exemplifies the fallacy referred to by Dunbar of confusing *is* and *ought*. There are now serious considerations of the policy implications of the evolutionary programme, from people of various political persuasions, including the left (e.g. Peter Singer author of *A Darwinian Left: Politics, Evolution and Co-operation*). Many female evolutionary researchers view themselves as feminists, and see no conflict with evolutionary analyses of human behaviour.

It is surely preferable to use empirical research rather than political dogma as a basis for social policy. The Roses dismiss Daly and Wilson's findings on stepchildren's risk of abuse, accusing them of 'silencing the voices of victims'. In contrast to this emotive rhetoric, Daly and Wilson rely on logical argument and careful empirical research, and have provided a great service to potential victims by highlighting important risk factors. It is the Roses who do a disservice to victims by seeking to obscure important research findings, and hence their policy implications.

The Roses seek to discredit the quality of research in evolutionary psychology, claiming that the data are 'limited and controversial'. The reality is that evolutionary research is as sophisticated as any in psychology today, and much of it conforms to the rigorous standards of leading APA journals. Neither is it the case that it is limited, since there are two specialist journals devoted only to evolutionarily based studies, and many

other high-quality journals, such as *Animal Behaviour* and *Proceedings of the Royal Society*, have published evolutionary research. A large body of findings has accumulated, as evidenced by various textbooks published on the subject.

The Roses' portrayal of evolutionary thinking as muddled and unsound involves an incorrect characterisation of its theoretical ideas. Near the beginning of their commentary, they state that it is necessary to distinguish proximal from distal mechanisms. In their discussion of what is or is not regarded as a family by particular individuals in contemporary society, they forget this injunction. They confuse kinship – a distal evolutionary mechanism – with proximal mechanisms – in this case the evolved dispositions that cause people to regard others as kin. The operation of these mechanisms leads us to regard as kin those with whom we share our lives, be they a pet dog or gay partner, to use the Roses' examples. That such non-adaptive attachments occur does not detract from the ultimate function of the mechanisms involved – kin recognition.

Throughout their commentary the Roses seek to obscure the sound theoretical basis of EP in evolutionary biology, partly by conflating proximal and distal explanations, but also by ignoring important evolutionary principles. Their discussion of kinship and family is greatly impoverished and muddled as a result of ignoring Hamilton's principle of kin selection. Another claim, that evolutionary psychologists impose the mating patterns of other species on humans, neglects the reality that it is broad principles, derived from modern sexual selection theory, that usually inform evolutionary hypotheses, not isolated examples from one species.

Such attacks on the scientific quality of evolutionary psychology obscure the real objection, that it provides a view of human behaviour that the Roses (incorrectly in my opinion) regard as being at odds with progressive political thinking. A paraphrase of the title of one of their articles – 'Do not adjust your beliefs, there is a fault in reality' – characterises their response to the challenge of evolutionary psychology.