Context, Environment, and Learning in Evolutionary Psychology

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Introduction

There is a widespread misunderstanding among social scientists that evolved psychological adaptations are like reflexes or “instincts” – blind, inflexible, and insensitive to social and environmental circumstances. Nothing could be further from the truth. Evolved psychological mechanisms are environmentally sensitive and exquisitely context-dependent.

The purpose of this entry is to introduce the reader to the centrality of context in evolutionary psychology. To this end, we discuss: (1) the theoretical importance of context in evolutionary psychology, (2) the nature of evolved learning mechanisms, and (3) specific examples of context effects in evolutionary psychology.

The Importance of Context in Evolutionary Psychology

Environmental context plays a key causal and explanatory role in evolutionary psychology. Adaptations – the primary products of natural selection – require environmental input at every stage of their emergence. Indeed, environmental pressures (1) drove the evolution of the adaptations in the first place, (2) play a key role in their ontogenetic development, and (3) are responsible for activating them in the present (Buss 1995; DeKay and Buss 1992). In other words, adaptations evolve because of environmental challenges in the first place, they require specific kinds of environmental input to develop properly across an organism’s lifespan, and proximate contextual input triggers their activation in the immediate present. Far from neglecting environmental context, an evolutionary perspective places it center stage.

Another way to see the centrality of context in evolutionary psychology is by considering two facts: (1) the brain evolved to extract information from the environment and use that information to regulate behavior, and (2) different contexts carry different information. Context is central in evolutionary psychology not only in the sense that different contexts present different adaptive problems, but, crucially, environments also *carry the information needed to solve those problems*. Stated differently, an organism’s brain – its evolved on-board computer – must monitor the

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environment for information relevant to the survival and reproduction of the organism.

In sum, context occupies center stage in evolutionary psychology for two broad reasons. First, adaptations require environmental input at every stage of their development, from initial evolution to current activation. And second, for an evolved information processor, context is central because it simultaneously poses key adaptive problems and carries the information needed to solve those problems.

Evolved Learning Mechanisms

There is a widespread misconception that "evolved" and "learned" are competing explanations. It might intuitively *seem* that "evolved" is the opposite of "learned," but this is dead wrong. These two kinds of explanations are not in conflict for two reasons.

First, they answer distinct questions at complementary levels of analysis. Learning explanations are at the *proximate* level of analysis, whereas evolutionary explanations usually begin at the *ultimate* level of analysis (see Alcock 2012; Tinbergen 1963; Lewis et al. 2017, for a discussion of the relationship between ultimate and proximate levels of analysis).

Second, *learning* requires *evolved learning mechanisms* instantiated in the brain. This is why a brain can learn things a cauliflower cannot: the brain is equipped with evolved learning mechanisms but the cauliflower is not (Tooby and Cosmides 2015). Similarly, if you try to teach a young dog and a human child the same material in the same way, they will learn different things. This is because the puppy's brain and the child's brain are equipped with different learning mechanisms. Far from being in conflict, evolution and learning are explanatory partners. To explain psychological and behavioral outcomes, you often need to invoke both evolution and learning in the form of evolved learning mechanisms.

Specific examples of evolved learning mechanisms illustrate this point. Three prominent examples are (1) food aversion learning, (2) specialized fear learning, and (3) incest aversion learning.

An example of food aversion learning is the Garcia Effect, which refers to the discovery that rats will readily learn to associate nausea with food, but not with lights or sounds (Garcia and Koelling 1966). The Garcia effect occurs because in rats' natural environment and across their evolutionary history, nausea was caused by toxic or pathogenic food but not by lights or sounds. This phenomenon demonstrates that rats have evolved to learn some things (the relationship between nausea and food) more easily and more readily than others (the relationship between nausea and buzzers).

Specialized *fear learning adaptations* are common among primates. Fear learning in monkeys is a good example. If an observer monkey watches a target monkey react to a snake with fear, the observer monkey will learn a fear of snakes easily and rapidly – sometimes even in a single trial (Mineka et al. 1984). By contrast, if an observer monkey watches a target monkey react with the same fear to a rabbit or flowers, the observer will usually fail to learn a fear of rabbits or flowers. Monkeys are biologically prepared to learn a fear of snakes, but not of rabbits and flowers. It is also harder to get them to *unlearn* it: it is more difficult to extinguish a fear of snakes than a fear of rabbits or flowers (Cook and Mineka 1990). This "biological preparedness" supports the view that organisms are not equipped with a single, all-purpose learning mechanism. Rather, species have evolved problem-specific learning mechanisms that are specialized for learning information relevant to the particular adaptive problems they encountered over the course of their evolution. Species that have no evolutionary history of being preyed upon by snakes, for example, have not evolved this specialized fear learning mechanism.

Human also have specialized fear learning adaptations for snakes, spiders, heights, darkness, and strangers, but not for evolutionarily novel hazards such as cars, carcinogenic food additives, and cigarettes – despite the fact that these are more dangerous and kill more people in modern environments (Marks and Nesse 1994).

Incest aversion learning differs from both food aversion learning and fear learning adaptations –

in the adaptive problem it solves, the environmental input by which it develops, and in the information-processing machinery that produces its behavioral output. The adaptive problem in this case centers on avoiding mating with close genetic relatives. But humans are not born knowing who their genetic relatives are – this information must be learned. Incest avoidance mechanisms appear to take in at least two key inputs from the environment during development: (1) co-residence during childhood, and (2) maternal perinatal association (if you are the older sibling, seeing your mother breastfeed the other child). To simplify the process, if the mechanism in question receives sufficient levels of these inputs (e.g., shared habitation, observing a child nursing from one's own mother, etc.), it tags the co-resident as a sibling or other close kin and produces a lack of sexual attraction to that person as well as disgust at the mere thought of having sex with that person (Lieberman et al. 2007; Westermarck 1891). On the other hand, if the evolved learning mechanism *does not* receive sufficient levels of these two key inputs, it does not tag the other individual as a sibling and does not produce incest aversion toward that person. This is how we avoid having sex with our genetic relatives – through a learning mechanism that evolved because of its adaptive value in preventing inbreeding depression (Lieberman et al. 2007; Rantala and Marcinkowska 2011; see Al-Shawaf et al. 2018, for a discussion of the significance of these findings with respect to a key misconception about evolution and behavior).

Food aversion learning, hazardous fear learning, and incest avoidance learning all illustrate the importance of evolved learning mechanisms. These examples highlight the key point that for two reasons, evolution and learning should not be thought of as separate processes in zero-sum competition with each other for explanatory power. First, learning requires *evolved learning mechanisms* instantiated in the brain. Second, evolution and learning offer answers at different levels of analysis – ultimate for evolution and proximate for learning. There is no necessary conflict between the two (see Lewis et al. 2017).

Context Effects in Evolutionary Psychology

Specific empirical examples help to illustrate the centrality of the environment in evolutionary psychology. This section details context effects in four areas of evolutionary psychological research: emotions, cooperation and altruism, lifespan development, and human mating.

Some theorists draw a distinction between *context* effects and *condition* effects, emphasizing that context refers to the external environment, whereas condition refers to the internal environment (an organism's psychophysiological state). However, there is no fundamental distinction here: the external and internal environment are both critical to survival and reproduction, and evolved psychological mechanisms are sensitive to both. Broadly conceived, the terms "environment" or "context" therefore include elements of the ecological environment (e.g., parasite type and prevalence, flora and fauna, dangers from drowning), the social environment (e.g., local sex ratio, cultural norms about mating), and the internal environment (e.g., an individual's mutation load, strength of immune function). We touch on all three.

Emotions

Evolutionary psychological thinking suggests that emotions are heavily context-dependent, and that this context-dependence is systematic and predictable rather than arbitrary and random.

Disgust provides a good example. An adaptive disgust system would be designed to respond to pathogen-dense environments by downregulating personality traits such as extraversion and openness to experience. This would have the effect of reducing exploratory behaviors and intimate interactions with others, thereby decreasing the likelihood of infection. This is exactly what studies find: priming people with pathogen salience makes them regard themselves as less extraverted and less open to experience, while also prompting avoidant motor behavior (Mortensen et al. 2010). Experimentally inducing disgust reduces people's desire for short-term mating (Al-Shawaf et al. 2018). Cross-cultural data show a similar pattern:

people who live in regions of the world with higher pathogen density tend to be lower in extraversion, openness to experience, and proclivity for short-term mating (Schaller and Murray 2008). Research motivated by the hypothesis that masculine facial features are indicative of immunocompetence has shown that women who are more concerned with pathogens and disease show a heightened preference for masculine faces (DeBruine et al. 2010). Research based on the idea that out-group members tend to carry novel diseases that the immune system is not prepared to deal with suggests that priming people with the context cue of disease salience makes them more xenophobic (Faulkner et al. 2004). The contextual variable of pregnancy status affects levels of disgust in a principled and functional way, preventing the mother from ingesting teratogens that could harm the developing fetus (Fessler et al. 2005; Profet 1992). Studies show that mothers find their own baby's feces less disgusting than other babies' feces (Case et al. 2006). Finally, evolutionary analyses of disgust suggest a host of novel context-based hypotheses (Al-Shawaf et al. 2016; Al-Shawaf et al. 2017). These examples all highlight the context-sensitive nature of disgust: this emotion is designed to adjust our psychology, physiology, and behavior in response to different contextual cues in order to help solve the survival- or reproduction-relevant problem at hand.

Emotions such as anger show a similar pattern of context-sensitivity. For example, the welfare-recalibration theory of anger posits that an organism gets angry when it detects that another individual has not placed sufficient emphasis on its welfare. The victim then displays anger in an attempt to "convince" the perpetrator to upregulate the value that he places on the victim's welfare (Sell et al. 2009). Just as this welfare-recalibration theory suggests, the contexts that trigger anger are systematically predictable: people react with more anger when they have suffered a large cost, when the perpetrator only gained a small benefit, and when the perpetrator knew exactly whom he was harming. Relatedly, when a victim discovers wrongdoing, the perpetrator typically attempts to defuse the victim's anger in a predictable manner: by asserting that the benefit he reaped was large, that he didn't realize how large the cost to the victim was, and that he didn't know exactly whom he was harming with his behavior (Sell et al. 2017). Finally, precisely as the theory predicts, context and condition affect individual differences in anger: more attractive women – and more attractive and more physically formidable men – anger more readily than their less attractive and less formidable counterparts (for a discussion of the logic underlying these predictions, see Sell et al. 2009).

The key point here is that an evolutionary psychological approach to the emotions emphasizes their context-dependence. Human emotions are activated by specific contexts, and these emotions subsequently regulate aspects of cognition, perception, physiology, and behavior in ways that are functional precisely because they match context. This is true not just of disgust and anger but also of pride (Sznycer et al. 2017), shame (Sznycer et al. 2016), jealousy (Buss 2000), envy (Hill and Buss 2006), sexual arousal (Al-Shawaf et al. 2016), hunger (Al-Shawaf 2016), love (Buss 2006), and, to our knowledge, all emotions. These emotions are functional precisely because they are so context-sensitive.

Cooperation, Altruism, and Group Living

The domains of *cooperation and altruism* nicely illustrate the centrality of context in evolutionary psychology. Key contextual variables in this area of research include how problems are framed, audience effects, and kinship.

One classic finding in this area of research is this: people perform poorly on abstract logical reasoning tasks such as the Wason Selection task when the problem is framed in terms of abstract letters and numbers, but they perform exceptionally well when the same problem is framed in terms of social exchange and cheater detection (Cosmides 1989). Because we have evolved to detect cheaters and rule violators in social exchange, but not to solve abstract logic problems involving letters and numbers, our performance on the former is much better than our performance on the latter. The remarkable thing about these findings is that the two problems are logically identical. Our vastly different performance is due to the architecture of our evolved psychological mechanisms in conjunction with a key contextual variable (in this case, whether the problem is framed in terms of letters and numbers or in terms of detecting cheaters; Cosmides and Tooby 1989). Similarly, because we evolved in an environment in which we had to solve problems involving *frequencies*, but not *probabilities*, we are much better at solving problems framed in a frequentist format than mathematically *identical* problems framed in a probabilistic format (Brase et al. 1998; Cosmides and Tooby 1996; Gigerenzer 1991). The key idea here is the same: our evolved psychological mechanisms are built to process some contextual cues – roughly, those that were ancestrally ecologically valid – but not others. As a consequence, these mechanisms can produce radically different outcomes because of a change in a single contextual cue.

Another key contextual variable in the domain of altruism and cooperation is the presence of an audience. Studies suggest that we are more altruistic in public than in private, and that we choose to engage in more effortful altruism when we are being watched compared to when we are not (e.g., Bereczkei et al. 2010). Research shows that we are keener to mete out moralistic punishments when other individuals in the group are likely to find out that we engaged in costly punishment (which benefits the entire group; Kurzban et al. 2007). Experiments on the evolved psychology undergirding our moral evaluations of others suggest that we like and trust people more when their moral beliefs appear deontological (rule-based) rather than consequentialist (outcome-based; Sacco et al. 2017). This, in turn, suggests a novel hypothesis: that people may tend to present themselves as more deontological when they are being watched than when they are alone.

Kinship is another contextual variable that plays a central role in people's altruistic behavior. We tend to help and bequeath our assets to kin more than non-kin, and to closer kin more than distant kin (Smith et al. 1987). People's preferred solution to the famous trolley problem changes when the potential victims are kin (Bleske-Rechek et al. 2010). We are more willing to sacrifice our weekends and a day's pay to search for perpetrators who victimized kin as opposed to non-kin (Lieberman and Linke 2007). We prefer harsher punishments for offenders when the victim is a genetic relative, as we do when a rule violator victimized an in-group member as opposed to an out-group member (Bernhard et al. 2006; Lieberman and Linke 2007). By contrast, we prefer *lighter* punishments when the *perpetrator* is a genetic relative. We are also more likely to attribute remorse to the perpetrator when he or she is a genetic relative (Lieberman and Linke 2007). Kinship is such an important contextual variable that people try to influence non-kin to induce higher levels of cooperation by invoking kin terminology: *brothers* in arms, a sorority of *sisters*, the *motherland*, and so on (Daly et al. 1997; Salmon 1998).

In sum, cooperation and altruism point to the same conclusion as that of emotions: context is crucial – and deeply embedded in the fabric of evolutionary psychological thinking.

Development

Lifespan development also exemplifies the importance of context in evolutionary thinking. We present a few examples from childhood and adulthood.

In infancy and early childhood, fears (e.g., fear of strange males) come online at the developmentally appropriate time – approximately when the developing organism begins to confront the relevant adaptive problem (in this case, coming into contact with strange adult males; Boyer and Bergstrom 2011). Later during development, some evidence suggests that father absence may channel children toward a path that includes earlier puberty, earlier reproduction, a stronger proclivity for short-term mating, and less investment in long-term relationships (Belsky et al. 1991; but see Comings et al. 2002, for a different explanation). Relatedly, the context of a harsh and unpredictable environment in early childhood appears to channel individuals toward greater future discounting, a stronger tendency to value immediate rewards over delayed gratification, and less investment in committed long-term mating

(Ellis et al. 2009; see Barbaro et al. 2017, for a different view and a cautionary note).

Other developmental work suggests that maternal care during infancy affects the development of neural systems involved in fear and stress reactivity. For example, the brains of rat pups who receive grooming, licking, and arched-back nursing develop in ways that lead to greater stress resistance, less fearfulness, and less behavioral reactivity to stress-inducing situations (Caldji et al. 1998).

Studies suggest that personality traits such as extraversion may be predictable on the basis of developmental context effects. High levels of extraversion can lead to increased mating opportunities by initiating more interactions with potential mates and by forming new friendships and valuable social alliances (Nettle 2005, 2006; Denissen and Penke 2008). Because more attractive individuals are more likely to reap mating benefits from the social interactions associated with high levels of extraversion, we should expect selection to have favored extraversion-calibrating mechanisms that are sensitive to an individual's own physical attractiveness. Indeed, studies show that both men's and women's physical attractiveness predicts their extraversion levels (Lukaszewski and Roney 2011). Because mates and positions of high social status are contested resources, high levels of extraversion can also expose individuals to competition and conflict, in particular among men (Lukaszewski and Roney 2011). Consistent with this, physical strength predicts extraversion among men.

The centrality of context continues to manifest itself throughout the lifespan. Men downregulate testosterone production after entering into a committed relationship, and downregulate testosterone further after having a child (Burnham et al. 2003; Gray et al. 2006). These changes are functional, as reduced testosterone facilitates deeper commitment to one's mate, reduced aggression, and greater investment in parenting. Evolved psychological mechanisms are – and indeed must be – exquisitely sensitive to context.

Mating

Like emotions, altruism, and development, the psychology of mating is highly context-dependent. We describe several examples, first from men's mating psychology and then from women's.

Men's Mating Psychology

Men who are satisfied in their romantic relationships tend to show less attentional adhesion to attractive women (Miller 1997; Maner et al. 2008). By contrast, men who are less satisfied and men with a stronger short-term mating orientation demonstrate more attentional adhesion to attractive women (Maner et al. 2007).

The temporal context of mating – short-term or long-term – also affects a variety of male mate preferences. For example, men's preference for intelligence depends on mating context (stronger preference in long-term mating), as does their perception of promiscuity (desirable in short-term mating but undesirable in long-term mating; Buss and Schmitt 1993; Goetz et al. 2012). Men interested in short-term mating display a heightened emphasis on bodily attractiveness relative to men interested in long-term mating, whereas those oriented toward long-term mating display a heightened emphasis on facial attractiveness (the body contains more information about current fertility, whereas the face contains more information about long-term reproductive value; see Confer et al. 2010). And many preferences and standards shift when men are pursuing short-term mating instead of long-term mating (e.g., standards are lowered for a variety of qualities during short-term mating; Buss and Schmitt 1993). Researchers have even hypothesized that the return to (pre-arousal) baseline after orgasm is different for men oriented toward short-term mating than for those oriented toward long-term mating (Al-Shawaf et al. 2016).

Men's own qualities affect their mating choices and proclivities as well. For instance, men higher in mate value tend to reduce their parenting effort and invest more in mating (Hewlett 1991). By contrast, those lower in mate value tend to invest more heavily in parenting (Smuts and Gubernick 1992). One's mate value or physical attractiveness may even influence one's preferred mating strategy (e.g., Al-Shawaf et al. 2015; Gangestad and Simpson 2000). Preliminary molecular genetic evidence suggests that men with longer CAG repeats at the androgen receptor locus (i.e., men with reduced sensitivity to testosterone) are more likely to interpret ambiguous cues as indicative of their mate's infidelity and react with greater emotional upset to such cues (Lewis et al. 2018).

Studies also suggest that merely being exposed to attractive women causes men to declare that they are more ambitious and more interested in accruing wealth and succeeding in their careers (Roney 2003). Similarly, the mere presence of attractive female observers causes male skateboarders to experience a rise in testosterone, take more risks, and have more accidents (Ronay and Hippel 2010). And research suggests that looking at pictures of attractive models leads men to feel less committed to, less interested in, and less serious about their own partners (Kenrick et al. 1994).

Women's Mating Psychology

Women's mating psychology is also highly context-sensitive. For example, women of higher mate value have higher mating standards, demanding higher minimum levels of various attributes in their partners (Buss and Shackelford 2008; Waynforth and Dunbar 1995). Similarly, women with higher incomes and higher levels of education display a heightened preference for income, career, and educational attainment in their mates (Buss 1989).

Women, like their nonhuman female counterparts, engage in *mate choice copying* – a phenomenon whereby women find a man more attractive if he is already mated (Dugatkin 2000; Waynforth 2007), especially if his mate is highly attractive and appears to be genuinely interested in him (e.g., Place et al. 2010; Waynforth 2007). That is, women appear to use the social-contextual input of other women's choices to process information about a man's likely mate value.

Women's specific mate preferences also appear to depend on mating context, with increasing interest in traits such as muscularity, masculinity, confidence, physical attractiveness, and facial symmetry during short-term mating (e.g., Buss 2016; Gangestad et al. 2007; Li and Kenrick 2006; Provost et al. 2008). Relatedly, women's desire for extra-pair affairs is highly context-sensitive: it is primarily women whose partners lack hypothesized cues of good genetic quality who exhibit a desire for extra-pair copulations (Gangestad et al. 2005). Furthermore, when they do have affairs, women appear to specifically pick men who possess these attributes (e.g., facial symmetry, physical attractiveness; Gangestad and Thornhill 1997). Even women's competitor derogation is exquisitely context-sensitive; the types of slurs women use to derogate their rivals vary systematically as a function of mating context (Buss and Schmitt 1993; Schmitt and Buss 1996).

One of the most striking context effects in the domain of mating is the effect of a country's sex ratio – a key dimension of the social environment (Schmitt 2005). Cross-cultural studies of more than 14,000 participants in 48 nations demonstrate that when there is a surplus of women, mating strategies shift toward short-term mating and casual sex. By contrast, when there is a surplus of men, there are observable nation-level shifts toward long-term mating, monogamy, and commitment. This can be understood in economic terms: the mating market is a kind of biological market in which whichever sex is less common is in greater demand and therefore has more bargaining power. Because women, on average, have a stronger desire for long-term mating than men, countries with a dearth of women tend to shift toward long-term mating. By the same logic, because men, on average, have a stronger desire for short-term mating than women, countries with a dearth of men tend to shift toward short-term mating (Schmitt 2005).

These findings highlight that, remarkably, global patterns of casual sex and committed mating can be predicted in advance on the basis of the key contextual cue of sex ratio. Human mating psychology, like the rest of our evolved psychology, is powerfully affected by key contextual cues in ways that can be predicted *a priori* from an evolutionary perspective.

The Breadth and Diversity of Context Effects in Evolutionary Psychology

We have focused on four domains – emotions, altruism, lifespan development, and mating – to illustrate key points about the ecological, social, and internal contexts to which our evolved psychological mechanisms are designed to respond. But even these examples fail to capture the breadth and scope of context effects in evolutionary psychology. In this section, we present a further sampling of context effects to give the reader a sense of how important and ubiquitous context is in evolutionary thinking.

Hunter-gatherer groups differ from one another in their degree of egalitarianism and food sharing. These group differences can be predicted on the basis of resource variability - a key contextual cue (Cashdan 1980). The perceptual bias known as *auditory looming* is heavily context-sensitive, with the bias appearing only for harmonic tones (e.g., sounds created by animate organisms) and disappearing for non-harmonic tones (e.g., background noise such as rain or leaves rustling) – precisely as evolutionary reasoning would predict (Ghazanfar et al. 2002). People tend to be more accepting of women's casual sex, and less moralistic about it, in societies where women are more financially independent (Price et al. 2014). More physically formidable men are more likely to endorse militaristic solutions to national and global problems (Sell et al. 2012) and are more likely to endorse a self-serving position regarding wealth redistribution: among poor men, strength predicts increased support for wealth redistribution, and among rich men, strength predicts increased opposition to wealth redistribution (Petersen et al. 2013). In line with evolutionary reasoning, fathers (but not mothers) show discriminative parental care as a function of facial resemblance between offspring and parent (Platek et al. 2002; Platek et al. 2005). Because parasites degrade physical attractiveness, people attach more importance to physical attractiveness in parts of the world with greater parasite density (Gangestad and Buss 1993). Even women's behavior toward their male kin may be affected by the context variable of where they are in their fertility cycle (Lieberman et al. 2011).

These findings, across large swaths of content domains in psychology, capture only a fraction of the total set of context-based discoveries in evolutionary psychology. We include them here as a reminder that, despite having chosen to focus on four specific domains, context effects feature prominently in evolutionary psychology and permeate the entire discipline. The misconception that evolved psychological mechanisms are rigid and environmentally insensitive is pervasive, but deeply mistaken (see Al-Shawaf et al. 2018 for a discussion of additional widespread misconceptions about evolution and natural selection).

Conclusion

Our goal has been to demonstrate how essential context and environment are to evolutionary psychology. We think there are three main ways to appreciate this point. First, the environment is crucial to evolved adaptations at every stage of their emergence: their evolution, ontogenetic development, and immediate activation. Evolved adaptations would not exist without the environment, nor would the behaviors they produce. Second, *evolved learning mechanisms* simultaneously illustrate the centrality of context in evolutionary psychology and dissolve the fallacious (but common) dichotomy of "evolved versus learned." Food aversion learning, hazard-specific fear learning, and incest aversion learning all demonstrate that *learning requires evolved learning mechanisms*, and that these evolved learning mechanisms are highly context-sensitive. Third, a long list of prominent context effects in domains such as emotions, altruism, lifespan development, and mating show that the centrality of context is not just an abstract theoretical point of passing interest, but rather pervades all the empirical work evolutionary psychologists do.

In sum, context is central to the theoretical framework of evolutionary psychology. Without it, evolved psychological mechanisms would not make sense – and would not exist. Environmental pressures drove the evolution of these mechanisms in the first place, environmental inputs are the keys to activating them in the immediate present, and the primary function of said mechanisms is to extract information from the environment and use this information to adaptively regulate physiology and behavior (Tooby and Cosmides 2015). Looked at in this way, context lies at the heart of modern evolutionary psychology.

Cross-References

- ▶ Condition-Dependent Mating Tactic
- ▶ Early Attachment Experiences and Romantic Attachment
- ▶ Kin Recognition and Classification in Humans
- ▶ Life History Theory
- ▶ Sexual Strategies Theory
- ▶ Thirteen Misunderstandings About Natural Selection
- ▶ Tradeoffs in Mate Selection
- ▶ Trivers-Willard Hypothesis

References

Alcock, A. (2012). *Animal behavior: An evolutionary approach* (10th ed.). Sunderland: Sinauer Associates.

Al-Shawaf, L. (2016). The evolutionary psychology of hunger. *Appetite, 105*, 591–595.

Al-Shawaf, L., Lewis, D. M. G., & Buss, D. M. (2015). Disgust and mating strategy. *Evolution and Human Behavior, 36*, 199–205.

Al-Shawaf, L., Conroy-Beam, D., Asao, K., & Buss, D. M. (2016). Human emotions: An evolutionary psychological perspective. *Emotion Review, 8*(2), 173–186.

Al-Shawaf, L., Lewis, D. M. G., & Buss, D. M. (2017). Sex differences in disgust: Why are women more easily disgusted than men? *Emotion Review, 10*(2), 149–160.

Al-Shawaf, L., Zreik, K. A., & Buss, D. M. (2018). Thirteen misunderstandings about natural selection. In T. K. Shackelford & V. A. Weekes-Shackelford (Eds.), *Encyclopedia of evolutionary psychological science*. Springer, New York.

Al-Shawaf, L., Lewis, D. M. G., Ghossainy, M. E., & Buss, D. M. (2018). Experimentally inducing disgust reduces desire for short-term mating. *Evolutionary Psychological Science.* https://doi.org/10.1007/s40806-018-0179-z.

Barbaro, N., Boutwell, B. B., Barnes, J. C., & Shackelford, T. K. (2017). Genetic confounding of the relationship between father absence and age at menarche. *Evolution and Human Behavior, 38*(3), 357–365.

Belsky, J., Steinberg, L., & Draper, P. (1991). Childhood experience, interpersonal development, and reproductive strategy: An evolutionary theory of socialization. *Child Development, 62*(4), 647–670.

Bereczkei, T., Birkas, B., & Kerekes, Z. (2010). Altruism towards strangers in need: Costly signaling in an industrial society. *Evolution and Human Behavior, 31*(2), 95–103.

Bernhard, H., Ernst F., and Urs F. (2006). Group affiliation and altruistic norm enforcement. *American Economic Review, 96(2)*, 217–221.

Bleske-Rechek, A., Nelson, L. A., Baker, J. P., Remiker, M. W., & Brandt, S. J. (2010). Evolution and the trolley problem: People save five over one unless the one is young, genetically related, or a romantic partner. *Journal of Social, Evolutionary, and Cultural Psychology, 4*(3), 115.

Boyer, P., & Bergstrom, B. (2011). Threat-detection in child development: An evolutionary perspective. *Neuroscience & Biobehavioral Reviews, 35*(4), 1034–1041.

Brase, G., Cosmides, L., & Tooby, J. (1998). Individuation, counting, and statistical inference: The role of frequency and whole object representations in judgment under uncertainty. *Journal of Experimental Psychology: General, 127*, 1–19.

Burnham, T. C., Chapman, J. F., Gray, P. B., McIntyre, M. H., Lipson, S. F., & Ellison, P. T. (2003). Men in committed, romantic relationships have lower testosterone. *Hormones and Behavior, 44*(2), 119–122.

Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and Brain Sciences, 12*(1), 1–14.

Buss, D. M. (1995). Evolutionary psychology: A new paradigm for psychological science. *Psychological Inquiry, 6*(1), 1–30.

Buss, D. M. (2000). *The dangerous passion: Why jealousy is a necessary as love and sex*. New York: Free Press.

Buss, D. M. (2006). The evolution of love. In R. Sternberg & K. Weis (Eds.), *The new psychology of love* (pp. 65–86). New Haven: Yale University Press.

Buss, D. M. (2016). *The evolution of desire: Strategies of human mating*. New York: Basic Books.

Buss, D. M., & Schmitt, D. P. (1993). Sexual strategies theory: An evolutionary perspective on human mating. *Psychological Review, 100*(2), 204.

Buss, D. M., & Shackelford, T. K. (2008). Attractive women want it all: Good genes, economic investment, parenting proclivities, and emotional commitment. *Evolutionary Psychology, 6*(1), 134–146.

Caldji, C., Tannenbaum, B., Sharma, S., Francis, D., Plotsky, P. M., & Meaney, M. J. (1998). Maternal care during infancy regulates the development of neural systems mediating the expression of fearfulness in the rat. *Proceedings of the National Academy of Sciences, 95*(9), 5335–5340.

Case, T. I., Repacholi, B. M., & Stevenson, R. J. (2006). My baby doesn't smell as bad as yours: The plasticity of disgust. *Evolution and Human Behavior, 27*(5), 357–365.

Cashdan, E. A. (1980). Egalitarianism among hunters and gatherers. *American Anthropologist, 82*(1), 116–120.

Comings, D. E., Muhleman, D., Johnson, J. P., & MacMurray, J. P. (2002). Parent–daughter transmission of the androgen receptor gene as an explanation of the effect of father absence on age of menarche. *Child Development, 73*(4), 1046–1051.

Confer, J. C., Perilloux, C., & Buss, D. M. (2010). More than just a pretty face: Men's priority shifts toward bodily attractiveness in short-term versus long-term mating contexts. *Evolution and Human Behavior, 31*(5), 348–353.

Cook, M., & Mineka, S. (1990). Selective associations in the observational conditioning of fear in rhesus monkeys. *Journal of Experimental Psychology: Animal Behavior Processes, 16*(4), 372–389. https://doi.org/10.1037/0097-7403.16.4.372.

Cosmides, L. (1989). The logic of social exchange: Has natural selection shaped how humans reason? Studies with the Wason selection task. *Cognition, 31*(3), 187–276.

Cosmides, L., & Tooby, J. (1989). Evolutionary psychology and the generation of culture, part II. Case study: A computational theory of social exchange. *Ethology and Sociobiology, 10*, 51–97.

Cosmides, L., & Tooby, J. (1996). Are humans good intuitive statisticians after all?: Rethinking some conclusions of the literature on judgment under uncertainty. *Cognition, 58*, 1–73.

Daly, M., Salmon, C., & Wilson, M. (1997). Kinship: The conceptual hole in psychological studies of social cognition and close relationships. In J. A. Simpson & D. T. Kenrick (Eds.), *Evolutionary social psychology* (pp. 265–296). Mahwah: Erlbaum.

DeBruine, L. M., Jones, B. C., Tybur, J. M., Lieberman, D., & Griskevicius, V. (2010). Women's preferences for masculinity in male faces are predicted by pathogen disgust, but not by moral or sexual disgust. *Evolution and Human Behavior, 31*(1), 69–74.

DeKay, W. T., & Buss, D. M. (1992). Human nature, individual differences, and the importance of context: Perspectives from evolutionary psychology. *Current Directions in Psychological Science, 1*(6), 184–189.

Denissen, J. J. A., & Penke, L. (2008). Individual reaction norms underlying the Five Factor Model of personality: First steps towards a theory-based conceptual framework. *Journal of Research in Personality, 42*, 1285–1302.

Dugatkin, L. A. (2000). The imitation factor: Evolution beyond the gene. New York: Free Press.

Ellis, B. J., Figueredo, A. J., Brumbach, B. H., & Schlomer, G. L. (2009). Fundamental dimensions of environmental risk. *Human Nature, 20*(2), 204–268.

Faulkner, J., Schaller, M., Park, J. H., & Duncan, L. A. (2004). Evolved disease-avoidance mechanisms and contemporary xenophobic attitudes. *Group Processes & Intergroup Relations, 7*(4), 333–353.

Fessler, D. M., Eng, S. J., & Navarrete, C. D. (2005). Elevated disgust sensitivity in the first trimester of pregnancy: Evidence supporting the compensatory prophylaxis hypothesis. *Evolution and Human Behavior, 26*(4), 344–351.

Gangestad, S. W., & Buss, D. M. (1993). Pathogen prevalence and human mate preferences. *Evolution and Human Behavior, 14*(2), 89–96.

Gangestad, S. W., & Simpson, J. A. (2000). The evolution of human mating: Trade-offs and strategic pluralism. *Behavioral and Brain Sciences, 23*(4), 573–587.

Gangestad, S. W., & Thornhill, R. (1997). The evolutionary psychology of extrapair sex: The role of fluctuating asymmetry. *Evolution and Human Behavior, 18*(2), 69–88.

Gangestad, S. W., Thornhill, R., & Garver-Apgar, C. E. (2005). Women's sexual interests across the ovulatory cycle depend on primary partner developmental instability. *Proceedings of the Royal Society of London B: Biological Sciences, 272*(1576), 2023–2027.

Gangestad, S. W., Garver-Apgar, C. E., Simpson, J. A., & Cousins, A. J. (2007). Changes in women's mate preferences across the ovulatory cycle. *Journal of Personality and Social Psychology, 92*(1), 151–163.

Garcia, J., & Koelling, R. A. (1966). Relation of cue to consequence in avoidance learning. *Psychonomic Science, 4*(3), 123–124.

Ghazanfar, A. A., Neuhoff, J. G., & Logothetis, N. K. (2002). Auditory looming perception in rhesus monkeys. *Proceedings of the National Academy of Sciences, 99*(24), 15755–15757.

Gigerenzer, G. (1991). How to make cognitive illusions disappear: Beyond heuristics and biases. *European Review of Social Psychology, 2*, 83–115.

Goetz, C. D., Easton, J. A., Lewis, D. M. G., & Buss, D. M. (2012). Sexual exploitability: Observable cues and their link to sexual attraction. *Evolution and Human Behavior, 33*, 417–426.

Gray, P. B., Yang, C.-F. J., & Pope, H. G. (2006). Fathers have lower salivary testosterone levels than unmarried men and married non-fathers in Beijing, China. *Proceedings of the Royal Society of London B, 273*, 333–339.

Hewlett, B. S. (1991). *Intimate fathers: The nature and context of Aka Pygmy paternal infant care*. Ann Arbor: University of Michigan Press.

Hill, S. E., & Buss, D. M. (2006). Envy and positional bias in the evolutionary psychology of management. *Managerial and Decision Economics, 27*(2–3), 131–143.

Kenrick, D. T., Neuberg, S. L., Zierk, K. L., & Krones, J. M. (1994). Evolution and social cognition: Contrast effects as a function of sex, dominance, and physical attractiveness. *Personality and Social Psychology Bulletin, 20*(2), 210–217.

Kurzban, R., DeScioli, P., & O'Brien, E. (2007). Audience effects on moralistic punishment. *Evolution and Human Behavior, 28*(2), 75–84.

Lewis, D. M., Al-Shawaf, L., Conroy-Beam, D., Asao, K., & Buss, D. M. (2017). Evolutionary psychology: A how-to guide. *American Psychologist, 72*(4), 353.

Lewis, D. M. G., Al-Shawaf, L., Janiak, M., & Akunebu, S. (2018). Integrating molecular genetics and evolutionary psychology: Sexual jealousy and the androgen receptor (AR) gene. New York. *Personality and Individual Differences, 120*, 276–282. https://doi.org/10.1007/s40806-018-0179-z

Li, N. P., & Kenrick, D. T. (2006). Sex similarities and differences in preferences for short-term mates: What, whether, and why. *Journal of Personality and Social Psychology, 90*(3), 468–489.

Lieberman, D., & Linke, L. (2007). The effect of social category on third party punishment. *Evolutionary Psychology, 5*(2), 289–305.

Lieberman, D., Tooby, J., & Cosmides, L. (2007). The architecture of human kin detection. *Nature, 445*(7129), 727.

Lieberman, D., Pillsworth, E. G., & Haselton, M. G. (2011). Kin affiliation across the ovulatory cycle: Females avoid fathers when fertile. *Psychological Science, 22*(1), 13–18.

Lukaszewski, A. W., & Roney, J. R. (2011). The origins of extraversion: Joint effects of facultative calibration and genetic polymorphism. *Personality and Social Psychology Bulletin, 37*(3), 409–421.

Maner, J. K., Gailliot, M. T., Rouby, D. A., & Miller, S. L. (2007). Can't take my eyes off you: Attentional adhesion to mates and rivals. *Journal of Personality and Social Psychology, 93*(3), 389–401.

Maner, J. K., Rouby, D. A., & Gonzaga, G. C. (2008). Automatic inattention to attractive alternatives: The evolved psychology of relationship maintenance. *Evolution and Human Behavior, 29*(5), 343–349.

Marks, I. M., & Nesse, R. M. (1994). Fear and fitness: An evolutionary analysis of anxiety disorders. *Ethology and Sociobiology, 15*(5–6), 247–261.

Miller, R. S. (1997). Inattentive and contented: Relationship commitment and attention to alternatives. *Journal of Personality and Social Psychology, 73*(4), 758–766.

Mineka, S., Davidson, M., Cook, M., & Keir, R. (1984). Observational conditioning of snake fear in rhesus monkeys. *Journal of Abnormal Psychology, 93*(4), 355–372.

Mortensen, C. R., Becker, D. V., Ackerman, J. M., Neuberg, S. L., & Kenrick, D. T. (2010). Infection breeds reticence: The effects of disease salience on self-perceptions of personality and behavioral avoidance tendencies. *Psychological Science, 21*(3), 440–447.

Nettle, D. (2005). An evolutionary approach to the extraversion continuum. *Evolution and Human Behavior, 26* (4), 363–373.

Nettle, D. (2006). The evolution of personality variation in humans and other animals. *American Psychologist, 61* (6), 622–631.

Petersen, M. B., Sznycer, D., Sell, A., Cosmides, L., & Tooby, J. (2013). The ancestral logic of politics: Upper-body strength regulates men's assertion of self-interest over economic redistribution. *Psychological Science, 24*(7), 1098–1103.

Place, S. S., Todd, P. M., Penke, L., & Asendorpf, J. B. (2010). Humans show mate copying after observing real mate choices. *Evolution and Human Behavior, 31* (5), 320–325.

Platek, S. M., Burch, R. L., Panyavin, I. S., Wasserman, B. H., & Gallup, G. G. (2002). Reactions to children's faces: Resemblance affects males more than females. *Evolution and Human Behavior, 23*(3), 159–166.

Platek, S. M., Keenan, J. P., & Mohamed, F. B. (2005). Sex differences in the neural correlates of child facial resemblance: An event-related fMRI study. *NeuroImage, 25*(4), 1336–1344.

Price, M. E., Pound, N., & Scott, I. M. (2014). Female economic dependence and the morality of promiscuity. *Archives of Sexual Behavior, 43*(7), 1289–1301.

Profet, M. (1992). Pregnancy sickness as adaptation: A deterrent to maternal ingestion of teratogens. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 327–366). New York: Oxford University Press.

Provost, M. P., Troje, N. F., & Quinsey, V. L. (2008). Short-term mating strategies and attraction to masculinity in point-light walkers. *Evolution and Human Behavior, 29*(1), 65–69.

Rantala, M. J., & Marcinkowska, U. M. (2011). The role of sexual imprinting and the Westermarck effect in mate choice in humans. *Behavioral Ecology and Sociobiology, 65*(5), 859–873.

Ronay, R., & Hippel, W. V. (2010). The presence of an attractive woman elevates testosterone and physical risk taking in young men. *Social Psychological and Personality Science, 1*(1), 57–64.

Roney, J. R. (2003). Effects of visual exposure to the opposite sex: Cognitive aspects of mate attraction in human males. *Personality and Social Psychology Bulletin, 29*(3), 393–404.

Sacco, D. F., Brown, M., Lustgraaf, C. J., & Hugenberg, K. (2017). The adaptive utility of deontology: Deontological moral decision-making fosters perceptions of trust and likeability. *Evolutionary Psychological Science, 3*(2), 125–132.

Salmon, C. A. (1998). The evocative nature of kin terminology in political rhetoric. *Politics and the Life Sciences, 17*(1), 51–57.

Schaller, M., & Murray, D. R. (2008). Pathogens, personality and culture: Disease prevalence predicts worldwide variability in sociosexuality, extraversion, and openness to experience. *Journal of Personality and Social Psychology, 95*, 212–221.

Schmitt, D. P. (2005). Sociosexuality from Argentina to Zimbabwe: A 48-nation study of sex, culture, and strategies of human mating. *Behavioral and Brain Sciences, 28*(02), 247–275.

Schmitt, D. P., & Buss, D. M. (1996). Strategic self-promotion and competitor derogation: Sex and context effects on the perceived effectiveness of mate attraction tactics. *Journal of Personality and Social Psychology, 70*(6), 1185–1204.

Sell, A., Tooby, J., & Cosmides, L. (2009). Formidability and the logic of human anger. *Proceedings of the National Academy of Sciences, 106*(35), 15073–15078.

Sell, A., Hone, L. S., & Pound, N. (2012). The importance of physical strength to human males. *Human Nature, 23*(1), 30–44.

Sell, A., Sznycer, D., Al-Shawaf, L., Lim, J., Krauss, A., Feldman, A., Rascanu, R., Sugiyama, L., Cosmides, L., & Tooby, J. (2017). The grammar of anger: Mapping the computational architecture of a recalibrational emotion. *Cognition, 168*, 110–128.

Smith, M. S., Kish, B. J., & Crawford, C. B. (1987). Inheritance of wealth as human kin investment. *Ethology and Sociobiology, 8*(3), 171–182.

Smuts, B. B., & Gubernick, D. J. (1992). Male-infant relationships in nonhuman primates: Paternal investment or mating effort. In B. S. Hewlett (Ed.), *Father-child relations: Cultural and biosocial contexts* (pp. 1–30). Hawthorne: Aldine de Gruyter.

Sznycer, D., Tooby, J., Cosmides, L., Porat, R., Shalvi, S., & Halperin, E. (2016). Shame closely tracks the threat of devaluation by others, even across cultures. *Proceedings of the National Academy of Sciences, 113*(10), 2625–2630. 201514699.

Sznycer, D., Al-Shawaf, L., Bereby-Meyer, Y., Curry, O. S., De Smet, D., Ermer, E., … & McClung, J. (2017). Cross-cultural regularities in the cognitive architecture of pride. *Proceedings of the National Academy of Sciences, 114*(8), 1874–1879.

Tinbergen, N. (1963). On aims and methods of ethology. *Ethology, 20*(4), 410–433.

Tooby, J., & Cosmides, L. (2015). The theoretical foundations of evolutionary psychology. In D. M. Buss (Ed.), *The handbook of evolutionary psychology, second edition. volume 1: Foundations* (pp. 3–87). Hoboken: Wiley.

Waynforth, D. (2007). Mate choice copying in humans. *Human Nature, 18*(3), 264–271.

Waynforth, D., & Dunbar, R. I. (1995). Conditional mate choice strategies in humans: Evidence from 'Lonely Hearts' advertisements. *Behaviour, 132*(9), 755–779.

Westermarck, E. (1891). *The history of human marriage*. London: Macmillan.