

Original Article

Evolutionary Awareness

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Abstract: In this article, we advance the concept of “evolutionary awareness,” a metacognitive framework that examines human thought and emotion from a naturalistic, evolutionary perspective. We begin by discussing the evolution and current functioning of the moral foundations on which our framework rests. Next, we discuss the possible applications of such an evolutionarily-informed ethical framework to several domains of human behavior, namely: sexual maturation, mate attraction, intrasexual competition, culture, and the separation between various academic disciplines. Finally, we discuss ways in which an evolutionary awareness can inform our cross-generational activities—which we refer to as “intergenerational extended phenotypes”—by helping us to construct a better future for ourselves, for other sentient beings, and for our environment.

Keywords: evolutionary awareness, evolutionary psychology, morality, extended phenotypes

Introduction

One of the most important foundations of modern education is the scientific framework of evolution by natural selection. Not only does this framework encompass all of biology, but it is also fundamental to psychology, anthropology, history, economics, political science, and even art and aesthetics. This does not mean that these disciplines are “reducible” to evolution by natural selection or that other theoretical frameworks cannot explain any of their aspects, but that a proper understanding of them is incomplete without an understanding of their dependence on processes that have evolved for billions of years—processes that unite us and other organisms in the same tree of life.

Prior to the publication of Darwin’s *Origin of Species*, there was a coherent reason—if not an excuse—for humanity’s stumbling in the dark with respect to the origins, the present state (at the time), and the future of humanity. How could humanity improve the short-term and long-term well-being of individuals and societies if it lacked both the tools

and methods of modern science and the body of knowledge that could explain humanity's past and current functioning? After Darwin, however, this excuse is no longer tenable; by learning about our evolutionary origins and understanding the “universal acid” that is the theory of natural selection (Dennett, 1995), we have taken on the responsibility of applying this knowledge to the betterment of humans and, perhaps, sentient non-humans. Alas, generations after Darwin's *Origin*, broad swaths of the public, the media, and the academy (at least when it comes to the evolution of human mental life and behavior) are reluctant to embrace the very idea that could better the lives of individuals and societies.

Our definition of “better” can be discussed at two, sometimes irreconcilable, levels: 1) the level of individual well-being and 2) the level of societal well-being. At both levels, a proper understanding of evolution by natural selection (which includes a sophisticated understanding of human physical and mental traits) can promote self-knowledge, enhance social and economic prospects, and engender nurturing and thriving relationships. In this article, we argue for the implementation of evolutionary knowledge as a metacognitive framework—that is, as a framework that can inform our individual and collective decisions by setting up an overarching perspective from which we can examine our thoughts, emotions, and behaviors. We term this framework “evolutionary awareness.” First, we describe the moral foundations upon which our framework rests. Second, we present some possibilities for the application of our framework to several domains of human functioning. Although our discussion of such domains is not exhaustive, it is sufficient and general enough for others to widen this application to other domains. Finally, we discuss whether an evolutionary awareness may be reconciled with other fields of inquiry and propose the concept of *intergenerational extended phenotypes* to better understand the long-term effects of human decision-making.

Our approach rests on some of the latest findings in the evolutionary science of human behavior. These findings draw attention to several spheres of human interaction for which an evolutionary perspective can be used to identify the often “unconscious” roots of conflicts between individuals and societies. Our approach aims at a practical implementation of evolutionary principles for identifying some of the ultimate (in the historical sense) causes of conflict and lack of well-being. Unlike Wilson, Hayes, Biglan, and Embry's (2013) framework of “intentional change,” which focuses on bringing about positive individual and social changes by couching various tools of phenotypic plasticity (such as behavioral conditioning, cognitive therapy, and mindfulness meditation) within classic evolutionary theory, our approach seeks to identify the evolved, recurring patterns of human behavior—patterns that should be identified and understood before any attempt is made to modify them by cognitive-behavioral or mindfulness approaches. Indeed, totalitarian philosophies, whether Stalinism or Nazism, often fail because of their attempts to radically change human nature at the cost of human beings. In this sense, our discussion should be used to supplement Wilson et al.'s (2013) by highlighting those contexts of human interaction in which change is possible (or desired) and those in which it is not. We may come to find that it is sometimes easier to enact prosocial change by redirecting our evolved proclivities rather than resisting them.

The Ethical Dimension of an Evolutionary Awareness

We are always straddling the ethical divide—a ubiquitous dimension along which

our actions are judged by others and ourselves to be either ethical or unethical. This divide is not always apparent. Indeed, it is often hidden beneath layers of selfishness, group favoritism, religious morality, legal obfuscation, consumerism, and worldly practicality. We often must actively search for the ethical dimension in all our experiences. Navigating the world of selfishness and group favoritism is much easier because we evolved to be sensitive to these phenomena. Likewise, religious triangulations and politically-charged alliances—circumstances whose ethics are under the influence of an “evolved awareness”—are also easier to heed than is the call of the ethical dimension of an “evolutionary awareness.” Once one acknowledges the relative supremacy of the naturalistic worldview, and, more specifically, acknowledges one’s status as a biological being that possesses strong tendencies towards self-preservation and reproduction, one is forced to face the ethical repercussions of such an acknowledgment. Although we have some misgivings about employing such a dualistic framework, it is almost as if every one of our actions—from the pouring of coffee (e.g., where were those beans procured and at what human and environmental cost?) to the enactment of life-goals (e.g., how will I be able to benefit my fellow humans if I devote myself to scientific writing as opposed to law or civil service?)—can be judged as contributing or not contributing to the well-being of other humans. It is up to us to develop an intellectual understanding that can tackle these ethical dilemmas in a scientifically cogent manner.

Because individual choices lead to cultural movements and social patterns (Kenrick, Li, and Butner, 2003), it is up to every individual to accept the responsibility of an evolutionarily-informed ethics. Although we are confident that an evolutionary perspective can increase human well-being (both in an evolutionary sense of reproductive fitness and in a more general sense of human happiness, fulfillment, and meaning), we do not deny that this may come at some cost to our evolved reproductive interests, if only because of the time-consuming task of having to re-examine many of our automatically-enacted cognitions and behaviors from such an overarching perspective as biological evolution (see Vallacher and Wegner, 1989, for a discussion of “action identification theory”). However, as with any intellectually-motivated course of action, developing an evolutionarily-informed ethics entails an intellectual sacrifice: Are we willing to forego certain reproductive benefits or personal pleasures for the sake of building a more ethical community? Such an intellectual endeavor is not just relevant to academic debates but is also of great practical and ethical importance. To apply the paleontologist G. G. Simpson’s (1951) ethical standard of knowledge and responsibility, evolutionary scientists have the responsibility of ensuring that their findings are disseminated as widely as possible. In addition, evolutionarily-minded researchers should expand their disciplinary boundaries to include the application of an evolutionary awareness to problems of ethical and practical importance. Although deciphering the ethical dimension of life’s varying circumstances is difficult, the fact that there are physical consequences for every one of our actions—consequences on other beings and on the environment—means that, for better or worse, we are all players in constructing the future of our society and that all our actions, be they microscopic or macroscopic, are reflected in the emergent properties of our society (Kenrick et al., 2003).

Admittedly, the misuse of evolutionary thought by individuals and groups is a possibility, as is the likelihood that evolutionary research might be used to justify the “naturalness” of violence or infidelity. The preponderance of evidence for the existence of

manipulation and deception in nature—from parasites and their hosts, to behavior-altering flukes, to ingeniously devious predatory spiders (Aidoo, Terlouw, and Kolczak, 2002; Carius, Little, and Ebert, 2001; Jackson, Pollard, and Fijn, 2002; Libersat, Delago, and Gal, 2009; Ridley, 1993)—has made it clear that nature does not owe us either morality or immorality. That an understanding of evolved predispositions, motivations, and modes of behavior can be used by manipulative individuals to benefit themselves at others' cost is, of course, a possibility.

In addition to the benefits of cooperative kin-based and tribal coalitions, human intelligence and sociality may have evolved because of the reproductive benefits of social deception and manipulation (Bailey and Geary, 2009; Brüne and Brüne-Cohrs, 2006). We know that our great-ape cousins engage in deliberate distortions of the truth. Lower-ranking chimpanzees, for example, will hide food from higher-ranking males and deliberately avoid being in the vicinity of the hiding places when in view of the higher-ranking males (Hare, Call, Agnetta, and Tomasello, 2000; Hare, Call, and Tomasello, 2001). Likewise, although our ability to place ourselves in others' shoes—a necessary precondition for the implanting of false beliefs in others—develops at around age 4, our ability to spot deceivers develops much earlier (as would be expected if we accept that early-developing deceiver-detection abilities were necessary in an ancestral environment that was rife with liars and manipulators; see Flynn, 2006; Mascaro and Sperber, 2009). Beginning in preschool, we become progressively better at telling self-serving lies—i.e., lies that serve our evolved interests, be they avoiding punishment (Talwar and Lee, 2002, 2011) or acquiring a resource (e.g., procuring cards in a card game; Smith and LaFreniere, 2013). That these juvenile lies can develop into the prevarication and sophistry of politicians or the corporate doublespeak of business executives suggests that the misuse of scientific theories and findings is a real possibility (and, lest we forget, the use of science for nefarious ends such as systematic killing is attested to by history). Our hope is that by creating the conditions for the betterment of modern education in the realm of evolutionary science, a widespread realization that cooperation and reciprocity are preferable to manipulation and exploitation can take hold (Stewart and Plotkin, 2013; Axelrod, 2006). In what follows, we make a case for an ethical approach to the study of human evolution and its application to human behavior. To better understand what an evolutionary approach to ethics and morality entails, we first discuss the evolutionary history of human morality.

The evolution of human morality

Haidt (2012) proposed the existence of six psychological mechanisms (or “foundations”), each with its own evolutionary history and upon which most of human morality is based. These foundations are universal, although there are individual and cultural differences in the degree to which they are expressed. One such foundation—the one that is most salient to secular liberals—is what Haidt referred to as the “Care/Harm” foundation. This foundation is responsible for the emergence of such sentiments as the preservation of happiness, pleasure, and longevity, and the elimination of pain and suffering. In addition to the “Care/Harm” foundation, Haidt proposed the existence of a “Fairness/Cheating” foundation (i.e., proportionality between giving and taking) and a “Liberty/Oppression” foundation (i.e., the suspicion of selfish upstarts and despots). Although, collectively, these foundations have existed for millions of years of evolutionary history (could we raise children or have any type of intimate or cooperative relationship

otherwise?), their valuation did not reach intellectual and political sophistication until the coming of Enlightenment thinkers such as Thomas Payne and Thomas Jefferson, and neither were they philosophically explicated until Jeremy Bentham's and John Stuart Mill's advancement of utilitarian systems of ethics (although these had their antecedents in Epicureanism and other philosophies).

Haidt also proposed the existence of a "Loyalty/Betrayal" foundation and an "Authority/Subversion" foundation, each responsible for the moralistic sentiments associated with adherence to one's in-group and its leaders, respectively. Politically, these foundations have been active in extolling conservative and reactionary ideologies, exemplified by phrases such as "One nation under God" and "God save the queen." Because our ancestors depended on loyalty to their in-groups and their leaders to survive and reproduce, we all possess these foundations. Conservatives, however, tend to espouse ideologies that are in line with these group and authority-related foundations (often centered on "sacred values"; Atran and Axelrod, 2008) to a greater extent than do liberals (although there is some overlap when it comes to the "Fairness/Cheating" foundation and its embracement by classical liberals and conservative libertarians).

Our ancestors have been battling parasites and pathogens such as viruses, bacteria, lice, ticks, mites, and vermin for millions of years. Indeed, it is the perpetual arms races between viruses and hosts that may have led to the evolution of sexual reproduction as an antiviral adaptation in our early ancestors (Hamilton, Axelrod, and Tanese, 1990; Ridley, 1993). In addition to our biological defenses against viruses and bacteria (e.g., B-cells, antibodies, macrophages, etc.), we possess physiological adaptations that respond to threats of parasitism and contamination, such as disgust and the emetic response. We also possess many psychological adaptations that function to deter us from people, places, and situations that are associated with contamination (or, rather, would have been associated with contamination for our ancestors; Miller and Maner, 2011, 2012).

It makes sense that much of what falls within the realm of human morality—particularly, the moralizing of sexuality—stems from evolved mechanisms that motivate avoiding contamination. Accordingly, these evolved mechanisms are included in what Haidt refers to as the "Sanctity/Degradation" foundation of morality—usually manifested as an avoidance of out-group members and the strict imposition of sexual mores. In support of this, studies by Fincher, Thornhill, and colleagues have highlighted the extent to which a geographical region's pathogen load may explain the social and political circumstances of that region (Fincher, Thornhill, Murray, and Schaller, 2008; Letendre, Fincher, and Thornhill, 2010). Regions with a higher prevalence of parasites and pathogens—usually tropical and subtropical regions—also display the highest rates of ethnocentrism and xenophobia (often manifested as group-centered collectivist and conservative political ideologies; for alternative explanations of these findings, see Hackman and Hruschka, 2013).

Haidt's approach to the study of human morality is non-judgmental. He argues that the Western, cosmopolitan mindset—morally centered on the Care/Harm foundation—is limited because it is not capable of processing the many "moralities" of non-Western peoples. We disagree with this sentiment. For example, is Haidt really willing to support the expansion of the "Sanctity/Degradation" foundation (and its concomitant increase in ethnocentrism and out-group hostility)? As Pinker (2011) noted, "...right or wrong, retracting the moral sense from its traditional spheres of community, authority, and purity

entails a reduction of violence” (p. 637). We would be falling prey to the naturalistic fallacy if we failed to critically examine the (reproductive and non-reproductive) utility of our evolved morality in today’s world. It is for this reason that we advance a model that is centered on self-criticism and the occasional circumvention of our evolved psychology. Our model is compatible with Haidt’s model, but with the coming of medical and technological innovation and internationalist sentiments, moral foundations based on notions such as “sanctity,” “purity,” and blind commitments to sectarian interests and charismatic leaders are harming us more than they are helping (as instances of ethnic cleansing, genocide, and the waging of group-perpetrated religious and patriotic wars can attest). Thus, we admit to embracing our secular and liberal biases and of valuing some of our evolved moral foundations—namely, the utilitarianism, anti-totalitarianism, and libertarianism of the “Care/Harm,” “Liberty/Oppression,” and “Fairness/Cheating” foundations—over others. The model that we propose aims to up-regulate the activity of these humanitarian (and humanistic) moral foundations while down-regulating all others.

Again, we stress the distinction between our advocacy of the use of evolutionary science to *inform* humanity’s ethically-fraught decisions, and the use of evolutionary findings to *structure* human morality. Whereas the former approach makes use of biological findings to clarify the nature of humanity’s evolved biases and their consequences on individuals and societies, the latter can potentially further the worst of human nature by succumbing to the naturalistic fallacy. Thus, our concept of “evolutionary awareness” invokes only some of humanity’s evolved moral foundations. As such, our ethical stance is somewhat divorced from simple considerations of survival and reproduction and is, instead, a continuously evolving combination of both biological and cultural concerns. No doubt, our ethical system is partly based on the application of certain Enlightenment values to ensuring that individuals have the right to survive and reproduce (as opposed to forcing individuals to live according to various religious or political dogmas). Nevertheless, individual survival and reproduction is often furthered by the violent intrusion by some individuals onto the lives of others. As discussed by Pat Shipman in *The Evolution of Racism* (1994), the misuses of Darwinism in the 19th and 20th Centuries to further racist colonial policies and to legitimize eugenic programs of forced sterilization of immigrants and the mentally-ill should not be downplayed. Nor, however, should our fear of the misuse of science hinder us from unflinchingly examining ourselves as the biological beings that we are and using the fruits of such an examination to formulate courses of action aimed at bringing about individual and collective well-being. We admit to not having any clear-cut answers to the ongoing debates between individual and collective interests; nor do we have any hard-and-fast rules for applying deontological versus consequentialist systems of ethics to situations possessing contradictory moral alternatives. Instead, we hope that our subsequent discussion of the moral ramifications of our evolved nature might help individuals to make their own decisions in a context-dependent manner, knowing full well that many of our prescriptions for conduct are subject to change as situations themselves change and as more knowledge is gained.

Applications of Evolutionary Awareness

The “evolutionary awareness” concept has had a number of precedents in science and academia, reaching, perhaps, as far back as the Enlightenment. What distinguishes it

from the giants upon whose shoulders it stands, however, is its unprecedented potential to extend the biological and psychological sciences to the individual realm—a realm with social consequences. For the first time in history, we are capable of understanding our biological and psychological nature and using this understanding to inform our ethical deliberations at a personal and societal level. Unlike the failed utopias of state-instituted eugenics and Social Darwinism, evolutionary awareness—and other scientific/naturalistic approaches to ethics—empowers *individuals* to make informed choices from a perspective that is enlarged by deep history and ecological awareness.

Below, we discuss the utility of applying evolutionary thinking to domains such as sexual maturation, mate choice, intrasexual competition, and human culture to 1) argue for the relevance of evolutionarily-informed research on human psychology and behavior and 2) identify some of the ways in which an evolutionary awareness can be used to navigate the ethically-charged atmosphere of individuals and societies.

Evolutionary awareness and sexual maturation

Sexual maturation is a chaotic and emotionally stressful period in development. We are suddenly plunged into a world of novel drives, desires, thoughts, and social interactions. Navigating this world was no doubt stressful for our maturing hunter-gatherer ancestors. For the most part, their sexual maturation involved struggles with efficiently appraising their own and others' sexual attractiveness, battling sexual competitors, learning the courtship rituals of their culture, and enacting reproductive strategies that might have included acquiring short-term reproductive partners, investing in one long-term partner, or engaging in a dual mating strategy (see Pillsworth and Haselton, 2006) of securing a stable and nurturing long-term partner who could help to rear offspring while also pursuing short-term liaisons.

Although sexual maturation involves less intrasexual violence over mating rights in the Western societies of today than in ancestral and some modern societies (Kruger, 2010; Kruger and Nesse, 2007), the preponderance of evolutionarily novel cultural and technological tools and innovations has made the pubertal transition no less confusing, even if less dangerous. Most of us grew up in such modern environments and, aside from the few of us who were endowed with traffic-arresting good looks or with a precociously developing intuition about sexual and romantic matters, were left to navigate the labyrinth of sociosexual development without help from parents or teachers. In addition, most of us were bombarded with mixed messages during development, including the sexualized images permeating the media, the propaganda of anti-sex religious conservatives, and the biology-denying political correctness of gender feminists. It is thus no surprise that many took a longer time to reach psychological maturation in the mating arena than others. With the aid of an evolutionary understanding of human sexuality (and its dependence on developmental milestones as tracked by biologists and psychologists studying life history transitions; Del Giudice, Angeleri, and Manera, 2009; Ellis, 2004; Hill and Kaplan, 1999), we can better equip adolescents and adults to engage in physically and psychologically healthier, more emotionally fulfilling, more intellectually stimulating, more self-awareness inducing and, ultimately, more ethical sexual and romantic practices.

When not assaulted by conservative activists calling for “parental rights” in matters of sex education, the educators of safe-sex practices and contraception use have been effective in reducing the spread of sexually-transmitted diseases and unwanted teenage

pregnancies (Chin et al., 2012; Kirby and Laris, 2009). However, sex education in public schools could be supplemented with evolutionarily-informed, age-appropriate information pertaining to the psychological aspects of human sexuality. Below, we provide a sketch of what such an educational environment might entail.

First, we must recognize that to impart evolutionarily-cogent knowledge about human sexuality to juveniles and adolescents, we must understand the evolution-imposed opportunities and limitations to the teaching and learning of any subject. David Geary (2007), one of the foremost proponents of an evolutionarily-informed approach to education, argues that children are biologically primed to acquire some forms of knowledge more easily than others. For example, although even human infants and some non-human primates may be equipped with a nascent or rudimentary understanding of quantity and simple arithmetic (Beran, 2004; Wynn, 1992), extensive and explicit schooling is required for the development of more complex mathematical abilities. Geary terms these contrasting abilities as “biologically primary” and “biologically secondary,” respectively, and argues that educational practices must take into account the relative ease with which children can acquire knowledge that invokes the former as opposed to the latter.

Similarly, sex educators should be cognizant of the evolved opportunities and limitations of juveniles and adolescents with regard to understanding certain topics. Fortunately, sexuality and romantic life invoke many of our biologically primary abilities; much of the information, however, may not make sense unless children have reached certain developmental milestones (i.e., life history transitions such as puberty or menarche). Educators should anticipate these transitions and, if possible, develop systems by which these transitions can be made less turbulent and involve less ignorance than is currently experienced by coming-of-age youths. Furthermore, although sexuality is perhaps more interesting than differential calculus, adults who try to direct children’s dating and sexual behavior might be met with resistance or hostility. To counteract such possibilities, educators might need to implement a mixture of implicit, student-directed, and group-oriented learning practices with explicit instruction, as children are more accepting of information and influence coming from their peers than from their parents or teachers.

It is during the primary and secondary school years that children undergo the major physiological and psychological upheavals that are associated with puberty. As it stands now, parents, teachers, and school administrators might not be well-equipped to deal with such changes. Being as how children spend many of their waking hours in classrooms and school playgrounds and lunchrooms, biological ignorance on the part of well-meaning adult caregivers is inexcusable. Preventing boys’ playground tussles over social status, averting their distractedness by their physically-developing female peers’ bodies, trying to stifle girls’ indirect aggression, and curbing their naïve manipulation of others via their newly-discovered sexuality is as useless as trying to prevent the anatomical and physiological changes associated with puberty. Indeed, the hormonal effusions associated with such biological transitions do not stop at the blood-brain barrier. Parents, teachers, and school administrators must therefore anticipate and properly educate children about these psychological changes, in addition to their focus on reading and writing—and perhaps these traditional subjects might be combined with evolutionarily-informed lessons on biological and psychological development in new and creative ways. In what follows, we discuss two arenas where such an approach might prove successful: boys’ rise in

aggressiveness following adrenarche, and girls' susceptibility to early puberty following paternal neglect.

According to life history theory (Del Giudice, 2009; Del Giudice et al., 2009; Ellis, 2004, 2005), organisms have evolved to apportion their metabolic resources in an adaptive manner across the lifespan. For example, some species (e.g., elephants and humans) apportion most of their metabolic resources toward the production of only a few offspring that receive a great deal of parental care, whereas other species (e.g., mice and cockroaches) apportion most of their metabolic resources toward the production of many offspring that receive little parental care. Neither strategy is better or worse than the other, as each is associated with its own reproductive advantages and costs. Similarly, there is variation in life history strategies within individual species (though not to the same extent as the variation between species). Finally, organisms are often sensitive to the social and ecological cues of their developmental environments, cues which may be used to gauge the prospects of success for a number of different reproductive strategies. Such "conditional" adaptations are often influenced by factors such as the degree of nutritional resources or parental care encountered by the organism (Ellis, 2005).

Different sexes within a species often exhibit different life history strategies. For example, human males' reproductive success is limited by human females' mandatory investment in pregnancy and childcare, which has led to the evolution of men's greater propensity to engage in competition with other men over access to women (Trivers, 1972). Evidence suggests that this propensity appears early in development; specifically, it is with the influx of adrenaline during the juvenile transition (a period roughly corresponding to 7- to 10-years of age, referred to as "adrenarche") that children's behavior becomes sexually differentiated—e.g., boys become more interested in hierarchical competition with other boys and girls become more interested in childcare (Del Giudice et al., 2009). More generally, such hormone-mediated developmental shifts are what West-Eberhard (2003) refers to as "switch points" that correspond to the major transitions in morphology and behavior that organisms undergo as part of their life history. Anticipating this rise in boys' aggressiveness levels might help to moderate the adverse effects of this life history transition for the boys themselves, and for other children who might be adversely affected by such changes in boys' behavior. For instance, steps might be taken to introduce more healthy forms of competition, and for boys who may end up on the losing end of such bouts, alternative domains of competitive success might be suggested. Likewise, non-violent team-building exercises (be they sports- or video game-related) might be used as positive outlets for boys' evolved need to belong to competitive coalitions with other boys. The key, again, is to redirect children's evolved tendencies into more prosocial forms of behavioral expression rather than trying to stifle these evolved tendencies whenever they emerge as socially-undesirable behaviors.

As they approach puberty, girls experience similar hormonal transitions as do boys; however, there is evidence for a unique influence of paternal care (or lack thereof) on girls' pubertal timing, or menarche (Draper and Harpending, 1982; Ellis, 2004, 2005). Specifically, although nutritional stressors seem to delay the onset of menarche in girls, psychosocial stressors such as father-absence seem to expedite it. It is proposed that girls seem to be adaptively sensitive to the amount of paternal investment they experience in their early environments because the level of paternal investment experienced might cue them as to how likely they are to experience commitment and childrearing assistance from

men in general. That is, if a girl grows up without a father (or with a non-investing father), it might be to her advantage to forgo investing in the prolonged development of attributes that are helpful in securing a stable long-term mate and co-parent (attributes such as conscientiousness, self-control, and educational attainment) if the men in her environment have the same commitment and parenting deficiencies as her father. Instead, signals from her psychosocial environment might initiate a conditional hormonal response aimed at an earlier pubertal onset and, hence, an earlier and more frequent reproductive career. Such a shift to a faster life history strategy might be just as biologically adaptive as an investment in long-term mating and parenting, though in the modern environments of today, teenage pregnancy and a lack of education might subsequently lead to a life of ill health and poverty for the girl and her potential offspring.

The question of what—if anything—can or should be done to alter the course of girls' sexual maturation is one that is fraught with social and political implications. First, there is the question of whether early sexual maturation is indeed a problem. Although teenage pregnancy and a lack of long-term investment in educational and career opportunities are undesirable, infringing on a young girl's sexual development or a young woman's evolved sexual strategy might be a recipe for totalitarianism. Who is the government or the public school system to decide on the social desirability of one sexual strategy over another? Second, there is the possibility that girls from some racial or socioeconomic groups might be more affected by such developmental interventions than others. Just as the early 1990's Violence Initiative was met with misunderstanding and hostility stemming from the racially-charged nature of its supposed focus on young, mostly Black inner-city youths (Shipman, 1994), any biologically-driven approach to social policy is bound to be passionately opposed by political interests that detect a racial imbalance in its implementation. Third, and perhaps most importantly, there is no clear method for effectively altering the pubertal timing of girls. Although policymakers might be tempted to substitute male role-models and father-figures for absentee biological fathers, it is possible that the presence of a biologically-unrelated male (e.g., a stepfather or a mother's boyfriend) might actually speed up girls' sexual maturation (Ellis, 2005), not to mention increase the risk of abuse or neglect (Tooley, Karakis, Stokes, and Ozanne-Smith, 2006). Economic incentives aimed at preventing fathers from abandoning their daughters might hold some potential, though debates over who pays for such programs might keep them from ever being implemented in today's politically-polarized environment. Similarly, social or cultural movements focused on instilling values such as paternal commitment and investment might encounter political opposition over the singling out of some racial or socioeconomic groups over others—and it is not like such attempts at cultural change would be entirely new.

Although recent estimates show a substantial decline in teenage pregnancies (Hamilton and Ventura, 2012), their toll on young women's health, socioeconomic status, and educational opportunities necessitates that paternal investment and other biological influences on girls' pubertal timing are not ignored. We believe that a middle ground should be sought between respecting young women's developmental and sexual autonomy, and making sure that they have the educational and economic opportunities that they otherwise would not have if they were to get pregnant. As previously mentioned, a comprehensive sexual education that stresses both contraception and evolutionarily-grounded biological and psychological instruction might be able offer some solutions.

Any evolutionarily-informed sex education course should include (but not be limited to) topics such as physical and psychological sex differences, violent male-male competition, relational aggression between females, female choosiness and male readiness to engage in sexual behavior, the evolution of sexually transmitted parasites and pathogens, within-sex and between-sex differences in life history strategies, and the social interactions involved in parenting. Assuming the development of appropriate educational techniques, educators may also target students who are lacking in self-esteem or confidence—or who may be bullied by their more dominant peers into subordination—for programs of skill and confidence enhancement in the dating arena (e.g., students may be encouraged to develop a talent or to engage in better hygiene or sartorial practices as opposed to engaging in violence or sexual coercion). Far from being a *carte blanche* for permissive sexual practices, such an educational program may be effective in battling the ignorance that comes with adolescent violence and unsafe, impulse-driven sexual behavior, and may give students the confidence to resist maladaptive peer and cultural influences.

Evolutionary awareness and mate choice

The realm of mate choice presents opportunities for the enlightened extension of evolutionary understanding to problems of ethical concern. There is now a preponderance of research on why we find some individuals more physically attractive than others. Bilateral symmetry (i.e., a close correspondence between the left and right sides of the body and facial structure), for example, is valued as a mate characteristic by animals as diverse as humans, sparrows, and fruitflies (Brown et al., 2008; Gangestad, Thornhill, and Yeo, 1994; Hunt, Crean, Wood, and Gilburn, 1998; Moller, 1992). This is because symmetrical structures communicate a developmental history unperturbed by harmful genetic mutations, parasites, and other developmental stressors. Indeed, symmetry is related to a host of practical benefits such as balance, efficiency of movement, and—especially in humans—intelligence (Bates, 2007; Furlow, Armijo-Prewitt, Gangestad, and Thornhill, 1997; Prokosch, Yeo, and Miller, 2005). For similar reasons, “averageness” of features (i.e., not possessing an appearance that deviates overwhelmingly from the population average) is another characteristic that is correlated with attractiveness (Apicella, Little, and Marlowe, 2007). We might also do well to acknowledge the effects that hormones and other physiological processes have on our cognition and behavior. For instance, women’s mate preferences change as a function of their ovulatory cycle status (see Gangestad, Thornhill, and Garver-Apgar, 2005, for review). More to the point, women prefer dominant “hunks” when they are at peak fertility (presumably because such men are genetically well-endowed), but prefer men who promise long-term commitment, empathy, and paternal care when they are in the lower fertility phase. Acknowledging these influences on our mating decisions (in addition to their influence on how we treat friends and colleagues), should cause us to reexamine some of our implicit judgments, attitudes, and actions.

Characteristics such as physical attractiveness and dominance not only influence the treatment of individuals in our immediate vicinity, but also affect large-scale societal outcomes such as political elections. There is a growing body of research on the effects of physical characteristics such as candidate attractiveness, dominance, and voice pitch on the likelihood of election. For example, Little, Burriss, Jones, and Roberts (2007) found that people are more likely to cast hypothetical votes for masculine-faced candidates during wartime, but were more likely to vote for feminine-faced candidates during peace time. The

authors propose that this is due to an evolved propensity for humans to choose group leaders who are differentially suited to various group-related circumstances. In line with this prediction, candidates with lower-pitched voices and facial characteristics indicative of greater height are more likely to be chosen as leaders during wartime scenarios over candidates with higher-pitched voices and faces indicative of shorter stature (Re, DeBruine, Jones, and Perrett, 2013; Tigue, Borak, O'Connor, Schandl, and Feinberg, 2012).

These findings suggest that humans may be prone to making sub-optimal decisions when choosing their leaders, and that an evolutionary awareness might motivate us to re-examine our political decisions—decisions that can mean the difference between life and death on a global scale. Although Little et al. (2007) state that there may be “‘a kernel of truth’ in judgements made based on appearance and the belief that faces do provide valid guides to character” (p. 26), they also contend that because our decision-making psychology evolved in ancestral—rather than current—environments, “individuals appear to not consider aspects of large-scale technology-driven warfare and [instead] make the best choice for small-scale intergroup conflict” (p. 26).

Evolutionary awareness and intrasexual competition

Intrasexual competition includes many of the defining elements of ethically-charged human behavior. From individual-level violence to warfare, deception to exploitation, male-male competition is rife with the gravest of personal and social issues. This is evident not only in cases of physical violence between men who are competing for women (such as Aché tribesmen banging each other over the head with clubs), but also in cases of economic and resource-based competition. Much of socioeconomic inequality, for instance, can be explained as the indirect effect of men's competition over resources. Men who participate in a lab-based resource allocation task, for instance, are less likely to apportion resources to other men than they are to women, whereas women do not sexually discriminate in their generosity (Buunk and Massar, 2012). Although this type of competition is usually nonviolent, it can lead to the sequestration of environmental and monetary resources into the hands of the few, to the detriment of the many. Economic imbalance *per se* is not unethical (but see Daly, 2010, for the effects of economic inequality on societal violence), but a man aspiring to ascend the social-status hierarchy of the corporate world must choose whether he wants to pursue the course of honesty, cooperation, and philanthropy, or cheating, backstabbing, and white-collar crime. Of course, considerations of corporate decision-making has long had an ethical dimension, but what is missing from most discussions of business ethics is an evolutionary dimension—a dimension that not only informs individuals about the origins of psychological mechanisms responsible for unethical business practices, such as various forms of cheating (Cosmides and Tooby, 1992), but also suggests avenues for its reduction. Thus, although men may still be tempted to fudge tax-documents and bribe politicians, understanding that these behaviors are produced by evolved motivations to survive and reproduce may serve as a guide toward more ethically-sound survival and mate-acquisition tactics.

Male-male competition, whether a barroom brawl or a corporate stand-off, may lead to significant social consequences. Researchers have tracked changes in men's testosterone (a hormone that is positively associated with male pugnacity and sex-drive; Bernhardt, 1997; Rupp and Wallen, 2007) as a function of male-male competition. Men exhibit an increase in testosterone when they engage in competitive activities—especially athletic

activities (Trumble et al., 2012). Moreover, male winners (be they chess players, basketball players, or the supporters of a winning sports team or political candidate) exhibit an increase in testosterone (especially if they feel that they personally contributed to the victory), whereas male losers exhibit a decrease (Bernhardt, Dabbs, Fielden, and Lutter, 1998; Gonzalez-Bono, Salvador, Ricarte, Serrano, and Arnedo, 2000; Mazur, Booth, and Dabbs, 1992; Stanton, Beehner, Saini, Kuhn, and LaBar, 2009). Because social status is an important criterion on which women judge men's mate value, male winners may up-regulate their production of testosterone—and, hence, their sex-drive—in expectation of increased mating opportunities. This phenomenon is highlighted by the finding that men who are randomly assigned to drive luxury automobiles experience an increase in testosterone, whereas men who are given dilapidated clunkers experience a decrease (Saad and Vongas, 2009)—a physiological effect that may be reflective of the finding that women are more attracted to drivers of luxury cars than they are to drivers of more modestly-priced vehicles (Dunn and Searle, 2010). A series of studies that tracked the internet behavior of US voters likewise found that US states that overwhelmingly voted for winning candidates experienced a greater increase in internet pornography searches, whereas states that voted for losing candidates experienced a decrease (Markey and Markey, 2010, 2011). Because most consumers of pornography are male, this finding would suggest that men who are the vicarious winners of political contests may up-regulate their sex-drive in anticipation of increased mating opportunities—even if those opportunities do not materialize.

There are at least three reasons why men do not maintain a state of high testosterone indefinitely (which would presumably be an optimal strategy in a world where sexual opportunities are always present): 1) the dangers associated with competing with men of greater social status, 2) the possibility of squandering one's time and resources on women who are uninterested in low-status men, and 3) the health-related costs resulting from the immunosuppressive effects of testosterone (Alonso-Alvarez, Bertrand, Faivre, Chastel, and Sorci, 2007). As suggested by the “challenge hypothesis” (a concept initially applied to an evolutionary biological study of bird behavior but later extended to mammals and primates; see Archer, 2006), males experience an increase in testosterone and other androgenic hormones during the breeding season or—as in many primate species—during exposure to sexually receptive females. Because androgens are associated with male pugnacity and sex-drive, it is thought that these typically “male” hormones are responsible for physiologically and behaviorally readying males for increases in both competition with other males and sexual access to estrous females (Sobolewski, Brown, and Mitani, 2012). For example, in males of the African cichlid *Astotilapia burtoni*, hypothalamic neurons responsible for the release of gonadotropin-releasing hormone (GnRH)—a necessary step in the production of testosterone by the gonads—undergo a period of growth upon a male's rise in social status (Fernald, 2007). However, because of the costs associated with violent intrasexual competition and a decrease in the opportunity to maintain a territory and, hence, to attract mates, GnRH neurons decrease in size upon a male's descent in the dominance hierarchy (Francis, Soma, and Fernald, 1993; White, Nguyen, and Fernald, 2002).

The historical costs of competition between men are well-documented and include, for example: homicide, genocide, war, and economic inequality (the latter of which cannot be doubted given the preponderance of men in executive-level positions; see Daly and Wilson, 1988). A particularly insidious cost, however, involves men's propensity to link dominance-related aggression with sex-drive. For a number of scientific and political

reasons, academics can spend decades arguing about whether rape is produced by specialized adaptations. Its occurrence, however, remains a problem. That Nazi war crimes often were perpetrated with sexualized excitement (Theweleit, 1977/1987, as cited in Pinker, 2011), or that Russia's 1944 march across Poland often included the rape of local women (Smith, 2007), suggests that a metacognitive evolutionary perspective may be important for preventing such atrocities in the future. Understanding the influence of male-male competition on individuals and societies is a start.

Evolutionary awareness and culture

Prior to our discussion of how an evolutionary awareness can be applied to human culture, we must clarify what we mean by human "modularity" and "culture." Note that when we use the term "module" (or "evolved psychological adaptation," "mental process," "mental mechanism," "neurocognitive network," etc.), we are referring to any task-specific psychological system that is an evolved product of natural selection. We will not address the debate between massive modularity and domain generality except to say that many of our modules can perform a variety of different functions, are shaped by associative learning and experience (i.e., they are malleable), are composed of sub-modules and embedded in larger modules, may exhibit distributed network processes that are not topologically cogent across the neocortex, and depend on contextual and cultural influences for the development of their evolved functions (for further discussion, see Barrett, 2009; Fuster, 2003; Kurzban, 2010). By "culture," we refer to any material product, mode of behavior, or unit of knowledge that is not genetically inherited, can be transferred both within and between generations, and can progress by building on previously acquired products in a cumulative manner (see, e.g., Boyd and Richerson, 1996; Caldwell and Millen, 2008).

Human culture often reflects the dynamics of evolved modules. This reflection is not isomorphic; some modules may be inexpressible in human language or via other symbolic systems, and culture may exhibit emergent properties that have no analogs in the human mind. Even here, however, culturally "disconnected" modules may indirectly shape cultural products and information (e.g., color perception and its concomitant neuronal connections influencing art and fashion, sound perception influencing musical tastes, and gustatory and hunger-satiety mechanisms influencing cuisines). Whatever the limits of the correlation between evolved modular processes and culture, across evolutionary time, many of our modular processes were shaped by cultural processes (Boyd and Richerson, 2008; Herrmann, Call, Hernandez-Lloreda, Hare, and Tomasello, 2007) and, conversely, the imprint of our modular processes is embedded in cultural history and in today's cultural environment (Sperber and Hirschfeld, 1999). Below, we present examples of how human culture may reflect the functioning of our evolved psychological processes.

Primates are among the most socially complex animals on the planet. Within the primate order, the great apes are the most socially complex family, and within the great ape family, humans are the most socially complex species. Primates are known for their fixation on social coalitions, status hierarchies, and in-group-out-group dynamics. Subordinate chimpanzees, for example, can build and maintain coalitions with other subordinates for prolonged periods of time and use these coalitions to depose reigning dominant males in planned attacks of sometimes lethal violence (de Waal, 1996; Goodall, 1990). Likewise, chimpanzees are known to live in hierarchical communities that occasionally wage war on other communities over mates and verdant feeding patches

(Wilson and Wrangham, 2003). For the most part, these battles involve raids by a coalition of about six males on another community's territory. These coalitions mostly attack lone, unprotected individuals, often by kicking, punching, biting, battering with weapons such as sticks and projectiles, and, occasionally, by dismembering and mutilating the unlucky stragglers. With enough of these attacks, one group will extinguish another group and incorporate some of the defeated group's fertile females into its own community. Humans inherited these traits from our common ancestor with chimpanzees (who lived 5 to 7 million years ago), and have been annihilating out-groups of competitor hominins and impregnating their females ever since (our mating with and possible annihilation of the Neanderthals may be the most recent example: Hortola and Martinez-Navarro, 2013; Yotova et al., 2011).

At the cultural level, humanity shows no dearth of coalitional markers and group identities—from religious, political, and corporate affiliations, to sports team and rock-star fanbases. In modern environments, individuals may belong to social coalitions without ever interacting directly with other coalition members, as in online communities and other social media. If our coalitional nature is a product of millions of years of natural selection on our ancestors' brains and, conversely, if our brains are a product of millions of years of coalition-building, it is unsurprising that coalitional markers are so important in the history and current *milieu* of human culture. That is, our evolved coalition modules may culturally express themselves in multiple ways.

Male proprietariness of female sexuality, for instance, may be culturally expressed via patriarchal religious beliefs and practices such as opposition to abortion, the covering up of the bodies of wives, daughters, and sisters, and lethal violence that is referred to as “honor killing.” Many of these practices stem from evolved mental mechanisms that motivate men to act proprietarily toward their wives, daughters, and sisters. One such mechanism, which is directed towards wives and lovers, leads to the deployment of mate guarding tactics such as monitoring of women's whereabouts and associations, and more severe behaviors such as cloistering, physical and sexual violence, and even homicide (Wilson and Daly, 1998). There is evidence that such behaviors are produced by the evolved motivation of men to prevent cuckoldry and the associated reproductive costs of raising another man's offspring. Similar mechanisms associated with male proprietariness can be directed toward the sexual control of daughters and sisters, as men's genetic interests may be threatened if their female kin—i.e., individuals with whom they share genes—mate with men who are disapproved of by their fathers or brothers. Cultural and religious beliefs and practices may exacerbate such expressions of proprietariness and coercion by making it a “duty” to defend one's own or one's family's “honor” by punishing the “impurity” of one's wife, lover, daughter, or sister. Such motivations are often highly moralistic and may additionally invoke the “Sanctity/Degradation” foundation of morality. That the “Sanctity/Degradation” foundation is invoked may explain the coalitional nature of patriarchal cultures and religions whose moralistic disgust unifies them against the threat of sexually-impure, pathogen-carrying outsiders wishing to impregnate their wives, daughters, and sisters.

On the other side of the sexual divide, women also may coalesce into cultural groups that collectively represent their reproductive goals. Much like the female coalitions of our bonobo cousins, human females may compensate for their lack of physical and political strength by congregating in all-female coalitions that further their evolved

interests. For example, it is hypothesized that because of the incessant threat of sexual coercion and rape across our evolutionary history, women may have evolved rape-avoidance mechanisms, such as avoidance of strange men, avoidance of appearing sexually receptive, avoidance of being alone, and being aware of one's surroundings and engaging in defensive behaviors (McKibbin et al., 2009). Such a psychologically salient awareness of the possibility of rape may be partly responsible for the feminist movement's struggle against "rape culture" and its concomitant expressions of male misogyny and hypersexuality. Thus, certain forms of feminism may be the cultural manifestations of women's rape-avoidance modules. The evolutionary history of these modules is rooted in women's greater parental investment in gestation, lactation, and child-rearing—factors that contribute to women's greater need for physical safety and sexual choosiness compared to men.

Women may find that their vigilance with regard to the threat of rape is physically, psychologically, and economically taxing; indeed, some feminist movements are attempting to put the onus on men to avoid raping women, rather than focusing on women's rape-avoidance tactics (Williams, 2013). Although educating men about women's interests in avoiding rape and sexual coercion is important, to be effective, this education must be informed by evolutionary concepts such as differential parental investment and sexual conflict (Shackelford and Goetz, 2012). The latter concept describes a co-evolutionary arms-race between the sexes whereby an adaptation in one sex (e.g., men's sexual aggressiveness) evolves at a cost to the other sex (e.g., women's vulnerability to men's sexual aggressiveness). The other sex, in turn, must evolve counter-adaptations (e.g., women's rape-avoidance mechanisms) to defend its reproductive interests. Thus, the cultural struggle between patriarchal institutions and feminism may be a macroscopic manifestation of individual-level sexual conflict. Furthermore, in addition to its value in educating men about their aggressive impulses, the concept of sexual conflict suggests that an abandonment of focus on women's rape-avoidance tactics—as advocated by some radical feminists (MacDonald, 2008)—may endanger women by causing them to ignore their evolved defenses against rape and sexual exploitation. Although we should never excuse the blaming of women for their victimhood, neither should we expect that all men will suddenly stop raping and sexually coercing women. Therefore, it is equally inexcusable for politically correct interests to eviscerate women's last line of defense against rape and sexual coercion.

Evolutionary awareness and postmodernism

Not to wax ecumenical, but perhaps some of the critical tenets of postmodernism can at last be reconciled with the core tenets of evolutionary science. From the postmodern perspective, Darwinian thinking is (wrongly) considered as just another narrative—perhaps a "Eurocentric" structure with its own signs and symbols, often espoused by White, well-to-do men seeking to maintain their privileged status. From a Darwinian perspective, in contrast, much of postmodernism is viewed as unscientific, academically-legitimized obscurantism, often with intellectual and moral relativism as motivating factors. Despite the animosity within the ivory tower and the likelihood of there being irreconcilable modes of approaching knowledge in these disciplines, the evolutionary biological study of animal signaling and communication may help to forge an interdisciplinary bridge between evolutionary science and the empirically cogent aspects of postmodernism.

According to animal signaling theory, signals such as dogs' barks, lions' growls, birds' songs, or chimpanzees' hoots evolve only if they contribute to an organism's survival and reproduction. Organisms that exhibited such signals must have survived and reproduced more successfully than organisms that did not exhibit them. In turn, these signal exhibitors bequeathed their signaling abilities to their offspring. Over time, a population of non-signalers became a population of signalers within which each individual organism used its signaling abilities to enhance its survival and reproduction. For example, vervet and colobus monkeys, along with other primate and bird species, have evolved the ability to produce alarm signals that warn their groups about dangers (Leavesley and Magrath, 2005; Schel, Tranquilli, and Zuberbuhler, 2009). In the case of vervets (*Cercopithecus aethiops*), these signals are specific to the type of predator observed (e.g., eagle, leopard, or snake) (Seyfarth, Cheney, and Marler, 1980). The effect of such signals is, in turn, predator-specific. For example, if the alarm call forebodes an eagle attack, the monkeys seek shelter in tangled bushes while continuously scanning the sky for signs of the intruder. It is easy to imagine the evolutionary benefits of such signaling; because most primate troops are composed of extended kin (i.e., individuals who share genes with the signaler), signalers are helping to spread the signaling behavior by benefiting the very individuals who will likely pass this behavior on to future generations, even if the signaler may be imperiled by drawing the predator's attention to itself. Another benefit of signaling may stem from the diffusion of costs among unrelated signalers—that is, if the ratio of signaling costs to signaling benefits is such that the risks of producing an occasional signal are outweighed by the benefits of shared signaling among unrelated group members (an example of delayed reciprocity), signaling adaptations can be favored.

Of course, if we acknowledge nature's duplicity, then we should not be surprised that such signaling behaviors are often wielded to nefarious ends. Subordinate tufted capuchins (*Cebus apella*), for instance, produce false alarm calls when dominants are on the verge of monopolizing a food resource (Wheeler, 2009), causing the latter to scurry away in fear of a non-existent snake or ravenous feline. In a similar manner, male Formosan squirrels (*Callosciurus erythraeus taiwanensis*) emit deceptive alarm signals (usually meant to signal the presence of terrestrial predators such as feral cats) after copulating with females (Tamura, 1995). Because such signals have the effect of freezing other males in their tracks, signalers thereby increase their reproductive success by prolonging their access to the females which, in turn, reduces the risk of sperm competition from rival males. It is easy to see the parallels between these deceptive animal signals and the fear-inducing political messages coming from the politicians and media demagogues of our own species. Falsely claiming that others pose a threat to one's existence may indeed be an effective method of societal control. The dehumanization of Jews as disease-carrying vermin by Nazi propagandists (Smith, 2011) or the scare tactic of using non-existent weapons of mass destruction as a pretext for the 2003 U.S. invasion of Iraq, are handy examples of such deceptive fear-mongering in humans.

Do humans produce deceptive signals? The answer is a resounding yes!—not only because of the prevalence of deception in childhood, as previously mentioned, but also because of the high likelihood that our propensity for language creates innumerable opportunities for manipulation and exploitation. For example, Mercier and Sperber (2011) proposed that human reason did not necessarily evolve because our ancestors used it to arrive at accurate knowledge or to make good decisions, but because it helped them to win

arguments. By winning arguments, our ancestors could rise in social status and enjoy the reproductive benefits that came with this increase in prestige and influence. Thus, what are normally considered to be maladaptive errors in reasoning (such as the confirmation bias) might make sense if reason were deployed to support prior attitudes and motivations rather than to arrive at accurate knowledge or decisions. One can already imagine some of the questionable consequences of the deployment of reason in collective settings such as politics, religion, science, and academia, and in individual settings such as romantic relationships and friendships (the Bay of Pigs and the Challenger and Columbia disasters come to mind). However, humans also have the capacity to evaluate others' use of reason and, although we are bound to make mistakes, collective skepticism in science and philosophy may be reason's self-corrective antidote (Haidt, 2012).

Sperber (2010) likewise proposed the existence of the "guru effect"—a psychological propensity to believe that someone's obscurity or complexity in speech or ideas may be indicative of great wisdom or insight. This may mean that if executed correctly, incomprehensibility—especially alongside seemingly "reasoned" argumentation—might lead to an increase in one's social status and reputation for intelligence and profundity, which, in turn, could lead to a self-reinforcing cycle whereby one's reputation increases as one's incomprehensibility deepens. Thus, a politician, pundit, priest, or professor may be esteemed by thousands—and sometimes billions, if we discount the professor—of people, even if none of them can understand or evaluate any of his or her beliefs or attitudes. Such a phenomenon is referred to as "pluralistic ignorance," a collective delusion that the king's obscurantism is covering his nakedness.

These examples highlight the ever-present danger of deceptive and manipulative signaling in the human species. Especially in postmodernist and post-structuralist circles (where obscurantism seems to enjoy a laudatory pedestal), but also in many scientific disciplines (it cannot be denied that some scientific publications are accepted by respected journals due to the author's prestige and the journal's deference to authority), it is important to reexamine previously held ideas and the sources for embracing them. To reexamine the content and sources of our signals, symbols, and ideas—what more could a postmodernist, critical-theory espousing semiotician wish for?

Haphazard criticism is not enough, however; it must be supplemented with a Darwinian framework that is sensitive to the as-yet-unexplored, evolutionarily-derived sources of deception and misrepresentation. Much of the misinformation in the culture war between misogynistic patriarchal institutions on the one hand, and scientifically-uninformed gender feminists on the other, for example, may be exposed if we evaluate each side's arguments with the aid of evolutionary concepts such as parental investment and sexual conflict.

Intergenerational extended phenotypes

Organisms invest in reproductive resources cross-generationally. Indeed, parental investment is a "future-directed," intergenerational investment of reproductive resources in copies of one's genes that reside in one's offspring. Is it possible that humans might invest their reproductive resources in more than just one or two generations of children and grandchildren? Because of the human capacity to mentally travel in time (i.e., retrieving memories of the past and imagining the future; see Suddendorf and Corballis, 2007), humans are capable of waging evolutionary conflicts across more than just the immediate

two or three generations (the actual number would have to be investigated by field or modeling data). It is possible that intergenerational evolutionary conflicts may have been one of the sets of selection pressures that drove the evolution of human intelligence, as evidenced by the gradual expansion of our ancestors' craniums over the past two million years. Thus, much like the distinction between fast and slow life history strategists (and perhaps somewhat reflective of them), there may be differences in the extent to which individuals are informed by the imagined prospect of the future when making reproductively-relevant calculations. If such calculations are heritable, and provided they are conducive to an organism's reproductive success, the ability to perform them may have been naturally selected into the human lineage.

There are several hypotheses regarding the adaptive value of mental time travel. If, like us, our ancestors spent much of their time escaping the present moment, then such exhaustion of cognitive resources and inattention to one's current environment had to have given them a survival or reproductive advantage—otherwise, it would have been selected out of our species' repertoire (Bjorklund and Sellers, 2013). One possibility is that invoking neurocognitive networks associated with episodic memories helps humans to learn from past social and non-social mistakes to reach reproductively optimum decisions in the present and future (we are here excluding classically and behaviorally conditioned "memories" because, unlike our ability to mentally travel through time, they are not unique to humans; Suddendorf and Corballis, 2007). This is often accomplished via the formation of a "narrative self," perceived as an inner voice that is persistent through time and many of whose experiences can be verbalized (i.e., one can verbally describe one's past experiences and associate those experiences with one's stable self-identity). To prepare for the future, humans evolved the ability to imagine future possible worlds and outcomes. Such self-initiated "memories"¹ of the future may have helped our ancestors to anticipate climactic conditions, movements of prey and predators, and outcomes of familial and social relationships. Doing so could have helped them to avoid imagined futures that were unfavorable while working to bring about the ones that were favorable.

It would not be surprising if our ancestors, also like us, used their capacity for mental time travel to imagine the future successes and failures of their children—the very individuals who held their reproductive future on the line. When wedded to their propensity for the creation and preservation of cultural products such as beliefs, rituals, traditions, and modes of behavior, our ancestors' ability to remember the past and imagine the future of their family line may have been greatly expanded. For example, it is not unusual for hunter-gatherers to worship their distant ancestors—individuals who were thought to be present at the mythical time of creation. Examples of culturally-expanded intergenerational thinking are likewise ubiquitous throughout the historical period. For example, the Bible is replete with long genealogical tracts of who "begat" whom and exhortations to be "fruitful and multiply." Likewise, the modern period has been held hostage to the Nazi dream of the "Thousand-Year Reich," the "historical materialism" of Marxist utopians, various millennial and messianic movements, second comings, and mythical caliphates.

¹This is not just metaphorical; humans may be employing some of the same neuronal pathways during both their experience of past memories and their imagining of possible futures (Botzung, Denkova, and Manning, 2008; Schacter, Addis, and Buckner, 2007).

Humans use cultural products as *extended phenotypes*. According to Dawkins (1982), an organism's phenotype is not confined to its bodily frame but can encompass any adaptive structure or environmental alteration (e.g., anthills, termite mounds, beaver dams) that was naturally selected to aid the organism's (or, rather, its genes') reproductive success. Such extended phenotypes can even include other organisms—of the same or of a different species—that are manipulated into benefiting the organism that uses them for its own reproductive interests. An example of such extended-phenotypic manipulation is the behavioral manipulation of an ant by a parasitic lancet fluke that causes the ant (by chemically altering its nervous system) to position itself atop vegetation that is vulnerable to being eaten by a grazing animal—the fluke's ultimate host. Is it possible that humans have evolved to use cultural products such as religious beliefs and group identities as intergenerational extended phenotypes? That is, could the human propensity for the manipulation of cumulatively acquired cultural products—say, a religiously-motivated belief to be “fruitful and multiply”—be enacted as a way to ensure that one's progeny fruitfully multiply? Although the evidence for this is still lacking, there are some suggestions that such a dynamic may be at play.

Regardless of how conscious our ancestors were of the effects of cultural products, whether material or immaterial, on their and their offspring's reproductive success, there is evidence that many cultural trends throughout history were associated with changes in reproductive outcomes. (As an aside, such investigations suggest a mechanism for falsifying the present hypothesis; specifically, if it can be shown that individuals' or groups' cultural traditions preceded their genetic spread, such evidence would support—although it would not be decisive with regard to—the hypothesis that humans use culture to bring about their long-term reproductive success.) The first line of evidence comes from the advent of early Christianity. Scholars of the early Christian church believe that the historical Jesus was probably more provincial and Judeo-centric than he is characterized in the New Testament (Wright, 2009). Jesus' exhortation to “love thy neighbor as thyself,” for example, is thought to have been originally restricted to fellow *Jewish* neighbors and that it was the Apostle Paul who was responsible for giving Christianity its universal appeal by spreading the gospel to downtrodden and impoverished Romans. Whatever the cause of its success, its adoption spread like wildfire across the Roman world, partly as a result of the close-knit ties and cooperative networks generated among its adherents (Wilson, 2002; Wright, 2009).

Although, to our knowledge, there has not been a systematic analysis of gene spread across early Christendom, it is interesting to speculate about whether beliefs in universal salvation and in-group cooperation—perhaps wedded to apocalyptic, future-oriented beliefs such as Christ's second coming—could have helped the early Christians to spread their genes in addition to their religion, much like the cultural innovation of keeping livestock helped to spread the gene for lactose tolerance alongside herding cultural practices. The 16th Century rise of Calvinism and its concomitant beliefs in pre-ordained salvation and humble industriousness—beliefs associated with the “Protestant work ethic”—may have had a similar effect on the economic (and genetic) success of the American colonists (Wilson, 2002). Christianity, however, may not have always been a positive influence on the genetic success of populations. For example, Christianity may have indirectly led to the fall of the Roman Empire by pacifying its population into submission to the Vandals (Frost, 2010), as well as the fall of the early Viking settlers in Greenland to “pagan” Inuit invaders

(Diamond, 2005)—two outcomes that collectively highlight the occasional inefficiency (from a gene’s perspective) of cultural evolution.

The effect of evolved reproductive strategies on political and religious beliefs and behaviors is a vibrant field of investigation. Single women in the fertile phase of their ovulatory cycle, for example, are more likely to endorse political and religious liberalism. This effect is reversed for married women—that is, they tend to espouse more conservative and religious positions when they are at their most fertile (Durante, Rae, and Griskevicius, 2013). Durante et al. further showed that these individual and context-dependent changes in political and religious orientation lead to changes in political behavior; specifically, ovulating single women tended to vote for and donate money to the campaign of the more liberal presidential candidate (i.e., Barack Obama), while ovulating married women tended to vote for and donate to the more conservative candidate (i.e., Mitt Romney). The researchers suggested that the differential effects on political behavior lie in the different reproductive strategies employed by ovulating and non-ovulating women. Specifically, because single women who are fertile would be more likely to acquire high-status sexual partners by endorsing more liberal sexual norms, their voting behavior would tend to swing to the left. The researchers also suggested that because married women have much to lose by engaging in extra-pair copulations when they are ovulating (e.g., the loss of resources from spouses and the incurred shame from families and communities), they reinforce their own marital commitments by publicly endorsing more conservative sexual mores.

As suggested by Weeden, Cohen, and Kenrick’s (2008) research, however, monogamy-prone men and women (many of whom are married) might endorse more conservative religious beliefs and practices because those beliefs and practices might help them to deter infidelity and promote high fertility within the monogamous relationship. If that is the case, then Weeden et al.’s findings may provide an additional explanation as to why the ovulating married women in Durante et al.’s (2013) study tended to vote for and donate to the more conservative candidate: These women may have been endorsing their commitments to cultural monogamy and to the raising of large families, as advocated by religious injunctions to “be fruitful and multiply” and the “family values” and “pro-life” positions of conservative politics. That fast and slow life history strategies (that is, strategies that differ on investment in mating vs. investment in parenting, respectively) may differentially affect political and social positions is further attested by findings showing that sexually promiscuous individuals tend to endorse less restrictive drug laws, whereas sexually monogamous individuals tend to endorse more restrictive drug laws (Kurzban, Dukes, and Weeden, 2010; Quintelier, Ishii, Weeden, Kurzban, and Braeckman, 2013). If drug use is associated with sexual promiscuity (see Müller and Schumann, 2011, for a discussion of the aphrodisiac role of drugs), then individuals may be using religious and political positions on drug use to differentially manipulate others’ social and sexual behavior for their own reproductive benefit—that is, using other humans as extended phenotypes via the espousal of specific religious and political positions.

Taken together, these findings highlight the need for an increased acknowledgment, both inside and outside of academia, of how evolved interests (moderated by dispositional and contextual factors) influence national and international developments via the use of political and religious positions as extended phenotypic tools of social and cultural manipulation. We must also gain a fuller understanding of how our political and cultural beliefs may be used as intergenerational extended phenotypes. This concept shares

similarities with the “cultural niche construction” model of Laland, Odling-Smee, and Feldman (2001) and, specifically, Lehmann’s (2008) “posthumous extended phenotype” model, which states that niche-constructing extended phenotypes (such as beaver dams) are selected because of the benefits they confer to an organism’s offspring in addition to the organism itself. Lehmann suggested that if organisms are benefited by their ancestors’ extended phenotypic effects on their current environments, then, assuming they inherited their ancestors’ genes, those niche-constructing extended phenotypes will be under positive selection—even if the immediate generation is not benefited by the extended phenotypes it produces. Lehmann also suggested that extended phenotypic effects can lead populations to extinction while benefiting the lineage that possesses them. According to Lehmann (2008), the fact that agriculture enabled humans to build sedentary communities (which are the most optimal communities for the inheritance of extended phenotypes across generations), “...raises the intriguing question of the extent to which humans have been shaped by natural selection to behave in accordance to their impact on future generations, be it at a local or at a more global scale” (p. 560).

It is not clear what the effects of being evolutionarily aware of our political and social behaviors will be. At the least, we can raise the level of individual and societal self-awareness by shining the light of evolutionary awareness onto our religious, political, and cultural beliefs. Better still, by examining our ability to mentally time travel from an evolutionarily aware perspective, we might envision more humane futures rather than using this ability to further our own and our offspring’s reproductive interests. In this way, we may be able to monitor our individual and societal outcomes and direct them to a more ethical and well-being-enhancing direction for ourselves, for other species, for our—often fragile—environment, and for the future of all three.

Toward a Consilient, Metacognitive Evolutionary Paradigm

Is it worth gambling away my long-term commitment to a loved one for the opportunity to have a good time with an attractive liaison? Am I genuinely impressed by the new job candidate’s credentials or is his attractiveness preventing me from forming a more realistic assessment? Do I choose friends based on how caring, intelligent, or loyal they are, or am I swayed into befriending only the more attractive individuals? Is my testosterone-fueled sexual aggression the result of my winning a competition and thereby rising in social status and prestige? Do I vote for political candidates because of their credentials and society-benefiting policies or because of their appearance, manipulative speeches, demagoguery, or alignment with my selfish reproductive interests (characteristics that are nowadays exaggerated by the propaganda machine of corporate-funded political campaigns)? These are ethically-charged questions whose immediate urgency was not made apparent until the relatively recent investigations into our biological workings caused us to start questioning the Standard Social Science Model and its cultural determinism (Tooby and Cosmides, 1992). This academic soul-searching was in some ways a reflection of a more personal struggle that some academics had with the ethical implications of evolutionary science. Of course, there are still some scholars who are afraid to acknowledge the influence of Darwinian processes on human psychology and behavior—though their ranks are dwindling. Whether it is due to intellectual laziness or an unfounded association between evolutionary science and Social Darwinism, these scholars’ ethically-

blinkered views of humanity have failed to keep pace with the enlarged scope of ethical thinking that this revolution in academia has inspired.

Though there is as yet little empirical investigation of the effects of evolutionary education on intra- and inter-human dynamics, evolutionary thinking—whether about sexual maturation, mate selection, intrasexual competition, or the use of cultural beliefs as extended phenotypes—may help to enhance the quality of human relationships and to promote individual and social well-being. We hope that this discussion will contribute to the advancement of a metacognitive approach whose aim is the theoretical and empirical analysis of how individuals are physiologically, psychologically, and behaviorally affected by various forms of scientific and cultural ideas, be they evolution by natural selection or postmodernism. Such an analysis requires consilience across disciplinary boundaries that separate the sciences from the humanities (Wilson, 1998). For this endeavor to succeed, however, we may need to achieve an individual-level consilience of heretofore irreconcilable cognitive processes (modules?). An individually-enacted evolutionary awareness may be the first step toward such an enlightened synthesis of knowledge and interdisciplinary cooperation.

Unresolved issues

Although there is plenty of research on the effects of political ideas on voting behavior, what is missing is a systematic analysis of specific beliefs and forms of knowledge (e.g., religious, political, scientific, moral, aesthetic, etc.) on an individual's psychological state and on social behavior. A cross-disciplinary, cooperative approach like the one advocated here is necessary for such an investigation, although we admit that some of our suggestions may be scientifically faulty, undesirable, or impractical. A cross-disciplinary approach, however, is necessary to fully illuminate the range of analytical levels that such an investigation requires. The question arises as to what role ethics, both in the academic and non-academic sense, should play in this cross-disciplinary endeavor. An ethical system that is both context-dependent and metacognitive (i.e., capable of examining itself from evolutionary, developmental, social, and cultural perspectives) is necessary, although many of its formulations will no doubt be refined as knowledge is gained.

Although it is a perspective without which ethical discussions are incomplete at best, and disastrous at worst, evolutionary approaches to ethics must be part of a broader, consilient framework, both inside and outside of academia, if these approaches are to assist us in bringing about greater well-being. The reason for this is that evolutionary awareness—and science, in general—are systems of informing humans about the way the world works. As Sam Harris suggested in *The Moral Landscape* (2010), science has the power not only to describe reality, but also to inform us as to what is moral and what is immoral (provided that we accept certain utilitarian ethical foundations such as the promotion of happiness, flourishing, and well-being—all of which fall into Haidt's (2012) "Care/Harm" foundation of morality). Likewise, G. G. Simpson (1951) proposed that if there is any ethical lesson that we can learn from the evolutionary process, it is that of the acquisition, dissemination, and the responsible stewardship of knowledge. Harris's and Simpson's ethical stances both rely on knowledge and the methodology of science to illuminate our perspective and guide our decisions in a manner that is ethically sound.

Scientific knowledge, however, can be parasitized by selfish human tendencies to gain power over others or to inflict pain. Harris posits that because science often shows us

the very steps that are needed to bring about human well-being, it can be said to “determine” human values. The counter argument is that science can also show us how to increase pain and suffering, as is exemplified by the ingenious scientist-torturers of the Middle Ages, devising the most innovative inventions for inflicting cruelty on heretics, apostates, and blasphemers (Pinker, 2011), the considerable talent that went into the design of Zyklon B, the gas that would later be used in Nazi gas chambers, and, of course, the design of the atom and hydrogen bombs. This is why the scientific mindset is not inherently moral or immoral. We agree with Harris that, as an institution, science should be allowed—and, indeed, it should be exhorted—to facilitate the flourishing of human and non-human sentient beings. However, at least semantically, the various steps needed to be taken toward that betterment—as discovered or discoverable by science—are not values in themselves. Instead, they are the implementations of values—in this case, the increase of human and non-human well-being, pleasure, happiness, longevity, and contentment.

Because scientific knowledge is necessary but not sufficient for the advancement of human and non-human well-being, academic fields on the border between science and ethics are required. We hope that the framework we have advanced here may give rise to such a discipline in the evolutionary sciences—namely, a discipline that synthesizes knowledge from evolutionary, biological, and philosophical fields. The potential danger of such investigations is that the flip-side of knowing how to better our lives also means knowing how to make them worse. For this reason, ethically-minded academic fields must not neglect to share knowledge and collaborate with various social-workers’ groups, nursing organizations, and charitable foundations to occasionally get up from the armchair of philosophical ethics and work on “real world” problems.

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