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Evolving Science in Adolescence

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Running Header: Evolving Science

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Abstract

Ellis et al. bring an evolutionary perspective to bear on adolescent risky behavioral development, clinical practice, and public policy. They offer important insights that: 1) some risky behaviors may be adaptive for the individual and the species by being hard-wired due to fitness benefits; and 2) interventions might be more successful if they move with, rather than against, the natural tendencies of an adolescent. Ellis et al. criticize the field of developmental psychopathology, but we see the two fields as complementary. Their position would be enhanced by integrating it with contemporary perspectives on dynamic cascades through which normative behavior turns into genuinely maladaptive outcomes, dual processes in adolescent neural development, and adolescent decision-making. Finally, they rightly note that innovation is needed in interventions and policies toward adolescent problem behavior.

Evolutionary analyses of human development have gained increasing prominence in recent years by offering compelling accounts of the adaptive logic underlying observed patterns of psychobiological responding to variations in environmental experience. The lead theoretical article by Ellis and colleagues in this special section applies this critical lens to the problem of adolescent risky behavior, arguing that the well-documented propensity of adolescents to engage in high-risk behaviors represents a functional adaptation to the developmentally salient demands of the adolescent period, namely to maximize social status and mating opportunities. This evolutionary perspective on adolescent development offers hope of novel insights and intervention hypotheses that could inform a perplexing field. Because of contemporary challenges to support adolescents in general, and those who are especially troubled and troubling in particular, this hope is welcome.

Ellis et al. describe adolescence as a high-stakes transition from the safety net of one's parents to the bold-and-brave world of adulthood. One fact of contemporary society that makes the arguments by Ellis et al. even more salient is that the period of adolescence has become longer than ever. The age of pubertal onset has moved earlier by an average of one month per decade over the past century, and early exposure to the world's allures has been made ubiquitous by the internet. At the end of adolescence, financial independence, marriage, and stable career, all signs of adulthood, are not typically achieved until age 25 or later. The rocky ride is longer than ever.

Ellis et al. offer at least two insights that all developmentalists will be wise to embrace: first, that some of the seemingly dysfunctional risky behavior exhibited by adolescents may actually be functional, and, second, that interventionists might be more successful if they move

with, rather than against, adolescents' goals.

Before the benefits of this analysis can be realized, however, we must address several problems in the authors' framing of their argument that threaten to obscure readers' understanding of the "lay of the land" of current research on adolescent risk-taking behavior.

Normative and Extreme Behavior in Adolescence

Consistent with the Ellis et al. evolutionary analysis, mounting empirical work describing age-related changes in neurobehavioral function occurring across the transition from childhood to adulthood supports the view of adolescents as developmentally "primed" for risky behavior. Around the time of puberty, the brain appears increasingly sensitive to social and emotional rewards, while neural developments that help to consolidate impulse-control skills are not complete until the late teens or early twenties. This "maturational gap" is thought to heighten adolescents' susceptibility toward impulsive risk taking, especially within peer contexts, a behavioral phenotype that may confer some historical fitness advantage to adolescents themselves (e.g., via leveraging of social status and mating opportunities) and/or the species at large (i.e., via risky exploration of new territory and avoidance of inbreeding) (for a review, see Steinberg, 2008).

Given the broad congruence of the Ellis et al. perspective with these well-known and influential models, we find it perplexing that the authors frame their analysis as a counter-position to current research on adolescent risk behavior. We find this critique problematic on three main counts. First, the use of developmental psychopathology as a disciplinary foil to characterize current research on adolescent risk behavior ignores the theoretical diversity of the field, which incorporates contributions from prevention science, public health, judgment and decision making, developmental psychopathology, and developmental science more generally.

Second, alongside this overly narrow identification of the field's theoretical orientation, Ellis et al. utilize an overly broad view of the boundaries of "risk behavior" as a topic of inquiry.

Whereas the field has traditionally focused on behaviors with obvious potential for negative consequences to adolescents' health and well-being (e.g., unsafe sex, driving recklessly or while intoxicated, substance use, illegal behavior), Ellis et al. focus much of their argument on the status-enhancing functions of bullying (see "Key Insight #2), a class of behaviors rarely described by developmental scientists as a paradigmatic example of either risk taking or psychopathology. Although this portrait of the adolescent risk-taking literature as dominated by developmental psychopathologists attempting to pathologize all undesirable behaviors may enhance the rhetorical punch of the Ellis et al. argument, we believe it is an inaccurate and needlessly provocative critique of a genuinely multidisciplinary field.

Finally, the Ellis et al. critique of developmental psychopathology minimizes the contribution of that field to our understanding of individual differences. They cast the developmental psychopathology perspective as over-emphasizing psychopathology and offer, instead, a view of the functional benefits of risky behaviors for typically developing adolescents. Perhaps the optimum is in between. The insight of developmental psychopathology has been that some abnormal adolescent behaviors can be understood as normal behavior gone awry. The links between the normal and the abnormal are important insights that an exclusive focus on one or the other will miss. Thus, we believe that individual differences are crucial and that juxtaposing normative adolescent development with a dysfunctional extreme is important.

The Ellis et al. perspective would benefit from highlighting two points that are consistent with both developmental psychopathology and evolutionary theory. First, as Ellis et al. acknowledge, normative patterns of adolescent behavior (e.g., novelty seeking) that are adaptive

from an evolutionary perspective (e.g., exploration of new territory may have increased fitness) may or may not have adaptive benefits for health and well-being in contemporary contexts.

Whereas modestly risky behaviors might continue to be adaptive by promoting the withdrawal from one's family of origin and the transition to adulthood, we must not confuse them with the clearly maladaptive extremes of risky behavior. It is *not* adaptive in contemporary society to play drinking games and then drive an automobile down the wrong side of a highway, it is *not* adaptive for a lonely 14-year-old girl to offer herself indiscriminately and sexually to older boys, and it is *not* adaptive for a gang of teenage boys to bully and sexually coerce a 12-year-old girl. Although we might gain insight and appreciation for these behaviors by understanding their social and evolutionary context, and although their biological roots might have been selected by evolution many years ago, these behaviors are maladaptive in today's society.

Second, diverse individual differences are consistent with, even hypothesized by, evolutionary theory, because they keep the species ready to respond to diverse environmental challenges. Curiously, Ellis et al. do not emphasize the genuinely novel contribution of evolutionary theory that it might be functional for the species to retain diverse characters in order to protect against unexpected environmental challenges. For example, although impulsive decision-makers may adapt poorly to contemporary normative environments, they might be best equipped to respond to certain emergencies. Also, although unconventional thinkers might fail in typical educational settings, they might be the "genius discoverers" if given opportunity. It is adaptive for the species to retain this genetic diversity. Thus, the task of the socializing environment is not to "weed out" unsavory characters but rather to maximize gene-environment fit.

In trying to cast risky behaviors as normative, Ellis et al. offer the insight that "a given

choice might seem dysfunctional according to others' views of how to behave but still be the best choice for the person in question" (p. 2). We agree completely that this insight is pertinent, but the "best choice" from one's own perspective does not imply the optimal choice for that person, especially in the long term. Social information processing models of deviant behavior in adolescence (e.g., Dodge, 2006) describe the aggressive actor's perspective that a personal history of maltreatment can lead one to become hypervigilant to hostile cues from others, attribute malevolent intent to others even in ambiguous circumstances, generate self-defensive goals, and evaluate the immediate outcomes of retaliatory aggression as favorable enough to be the "best choice" in a particular situation, even if the long-term outcomes are incarceration and dysfunction. Such a description helps us understand the phenomenology of the aggressive adolescent without rendering the behavior as healthy. For the chronically aggressive adolescent, the pattern is tragic.

Evolutionary Theory and Adolescent Decision Making

Despite our objections to the rhetorical strategy adopted by Ellis et al., we recognize several insights from the evolutionary perspective that are pertinent for either normative or individual difference models of adolescent risk behavior. With respect to normative adolescent development, Ellis and colleagues provide a strong argument that researchers underestimate the importance of adolescents' status and mating concerns at their own peril. Emphasizing the importance of adolescents' relative success in maximizing social status and ensuring access to sexual partners for their ultimate reproductive fitness, the authors suggest that evolutionary pressures have selected for a suite of puberty-related changes that dramatically re-orient adolescent motivational systems toward pursuit of these relational goals. Although the outsized importance of socioemotional concerns to adolescent decision making has been emphasized by

others, little work has examined the specific mechanisms by which social motivational factors influence adolescents' risky decision making.

We believe that recent improvements in decision-making theory have established a fertile ground for exploring these social motivational effects. The decision-making framework describes a given choice as resulting from a comparison of the expected values of perceived choice options, which are each algorithmically evaluated as a weighted combination of estimated costs and benefits in domains relevant to a given decision-maker (e.g., health, safety, parental approval, social status, etc.). Importantly, the relative salience of a given evaluative domain – that is, the weight it carries in the cost/benefit computation – may vary based on qualities of the decision-maker (e.g., developmental stage) and the decision context (e.g., alone vs. with peers). From the Ellis et al. perspective, it is likely that adolescents assign much greater weight to the perceived social and romantic consequences of a given choice relative to all other evaluative domains of a decision. Furthermore, evolutionary theory suggests that variations in local peer ecologies (e.g., sex and age composition) should moderate adolescent behavior by influencing the motivational salience of social concerns. Recent experimental work on the influence of peer context on adolescent decision making support the viability of this broad proposition, showing effects of peer observation on adolescents' preference for immediate (vs. delayed) rewards and risky (vs. safe) display behavior (for a review, see Albert & Steinberg, 2011). We agree with Ellis et al. that much more work is needed to elucidate age- and context-related variation in social motivational dynamics, and the decision-making framework shows great promise as a means for evaluating some of the compelling hypotheses suggested by evolutionary theory.

Evolutionary Theory and Individual Differences in Development

Ellis et al. draw on Life History Theory to suggest that developmental responses to early

adversity – however maladaptive they may appear from a contemporary public health perspective – represent functional adaptations to resource-scarce environments that have historically increased an individual’s reproductive fitness. Specifically, childhood exposure to cues predicting future resource scarcity and/or high probability of morbidity/mortality are hypothesized to trigger a coordinated set of psychobiological changes that “speed up” development and orient one toward exploitation of immediate resources, even if this strategy entails putting oneself at greater risk of immediate or long-term negative consequences. This “fast” life history strategy represents a tradeoff in energetic resources away from investing in future quality of life (e.g., parental investment, social attachments, etc.) and toward maximization of immediate chances for reproduction (e.g., aggressive competition for position in dominance hierarchies and access to mates). In the language of self-regulatory theory, the fast strategy is analogous to an acquired “reactive” or “impulsive” mode of self-regulation.

Given the degree to which reactive/impulsive patterns of self-regulation are associated with poor outcomes across the developmental continuum, we welcome the novel hypotheses suggested by Ellis et al. regarding distinct classes of environmental exposure (i.e., cues of morbidity/mortality vs. unpredictability) that might serve as potent predictors of life history strategy. Further empirical work identifying the specific “valid and reliable” cues of environmental quality that best predict developmental variation in self-regulation could provide important targets for prevention efforts, as would research evaluating the possibility of critical periods during which an individual’s self-regulatory trajectory (or LH strategy) is more or less sensitive to these environmental cues.

Evolutionary Theory and Practice and Policy

Perhaps the most important contribution of evolutionary theory will be to clinical practice

and social policy. Although developmentalists will point out that some interventions proposed by Ellis et al. as emanating from evolutionary theory were, in fact, a product of developmental psychopathology (e.g., the Good Behavior Game, social skills training, and mentoring), we see enormous potential here and conclude our commentary by highlighting four principles to which Ellis et al. lead us and the challenges that remain.

First, because the early-adolescent push toward risky behavior may be inevitable, socializers may be wise to move with, rather than against, this tendency. As Ellis et al. suggest, hard-nosed, confrontational approaches such as zero tolerance, stiff punishments for misbehavior, and “Just Say No” to drugs may exacerbate rather than mitigate adolescent rebellion. In contrast, approaches that facilitate safe ways to explore may prove more successful. The challenge that remains is how to engineer the environment to optimize exploration in a safe context. Unfortunately, the art of fostering safe exploration is not clear. Should public policy allow the exploration of alcohol consumption by 18-year-olds in the “safe” context of the college campus? Surely, we cannot allow drug use and cigarette smoking by 16-year-olds because recent brain science tells us that adolescents are particularly vulnerable to the pernicious effects of these substances. But how do we restrict access, knowing that the very policies that prohibit use render use that much more alluring? Policies that rely on wise decision-making by adolescents may prove less successful than those that engineer the environment so that safe behavior is the only option. We see promise in automobiles that will not start if a high blood-alcohol level is displayed by the driver, a market in which cigarettes are so expensive that adolescents cannot afford them, and universal birth control. We need to protect adolescents from themselves.

Second, we should take solace in the fact that, if we stay out of the way, most adolescents will turn into responsible adults. We should resist the urge to overreact. This optimistic stance is

consistent with evolutionary theory and empirically supported by developmental studies.

Unfortunately, many public policies respond to adolescent misbehavior in ways that perpetuate or even exacerbate maladaptive behavior. Overly stiff sentences for first-time crimes may turn otherwise adolescence-limited delinquents into career criminals. Suspending middle-school students for unexcused absences may lead them to drop out altogether. Public labeling of deviants, aggregation of offenders into all-deviant-group settings, and placement of young minor offenders with older more severe offenders, which are our primary public policies today, may send adolescents on a trajectory from which they cannot return. Of course, a policy of no consequences at all for misbehavior is unacceptable to the public and probably serves adolescents poorly. So how do we balance the public need for law and order with the scientific knowledge that adolescents are likely to “grow out of” their risky tendencies?

Third, evolutionary theory does not stipulate that humans grow without nurturing transaction with their environment, and so there is an important place for practices and policies that promote the development of adolescent self-regulation and decision-making skills. Although Ellis et al. make the valuable point that some well-intended interventions may impair normative development, this caution should not impede our striving for interventions that do help adolescents. Humans have evolved to *need* environmental scaffolding to support development, and adolescence is no different from any other era. Some interventions, such as public education for literacy and life skills training for behavioral decision-making, are constructed by cultures to enable us to learn the skills that we have evolved. When ordinary universal practices are not sufficient or have failed, supplementary clinical interventions are no more extraordinary than medicine or diet. Professional therapies such as multisystemic therapy and cognitive-behavior therapy have been uniquely tailored to the needs of some adolescents in our culture.

Consistent with the theme of moving with rather than against natural tendencies, we suggest that strategies that catalyze intrinsic interests will be most successful in developing enduring skills. For example, most adolescents want the freedom that comes with a driver's license, even though they are at relatively high risk of dangerous accidents. Increasing the age at which licenses are awarded is not likely to become public policy, but the allure of driving can be used to teach responsible decision-making. Many states have followed North Carolina's lead in the graduated driver's license, in which initial licenses are awarded that allow driving only before 9pm and with no more than one peer in the automobile. Over time, privileges are increased as long as no infractions have occurred, until full licensure. The policy recognizes the limited ability of the average adolescent, protects adolescents from themselves, and supports the development of skills and responsibility. Similar concepts could guide policies for other risky-but-important domains such as alcohol consumption, curfews, school completion, sex, and independent living.

Finally, evolutionary theory, along with emerging science in genetics and behavior, tells us much about clinical interventions to address individual differences. Our species is diverse by the "design" of evolution. Humans respond differently to environmental stimuli. Rather than program the same intervention for all adolescents, we can optimize impact by matching interventions to the learning style and temperament of the individual. Developmental psychopathology tells us that individual differences tend to mimic the variation that is observed across development; thus, some individuals may be excessively impulsive whereas others are exceedingly cautious, and some may learn best from didactic instruction whereas others learn optimally from visceral experience. Genotyping offers the as-yet-unrealized hope for "personalized" interventions based on one's DNA. We are far from there, but we *can* assess

stable differences in learning styles and then match interventions to individuals. Rather than force square pegs into round holes, we can embrace differences among individuals as the signature of our species and use our evolved capacity to engineer environments in ways to enhance individual development.

Conclusion

Upon reading Ellis et al., one can readily imagine a conversation between an adolescent and her or his parent, in which the adolescent rationalizes last night's drunkenness and pleads for the car keys, an indefinite curfew, and less monitoring of... everything. The parent shakes her head skeptically and prays that the teenager (and the parent) survives to adulthood. Ellis et al. try to help the parent understand, calm down, become more optimistic, and think about different tactics. For this contribution, we congratulate them.

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Footnote

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