Immediate Survival Focus: Synthesizing Life History Theory and Dual Process Models to Explain Substance Use

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Abstract: Researchers have recently applied evolutionary life history theory to the understanding of behaviors often conceived of as prosocial or antisocial. In addition, researchers have applied cognitive science to the understanding of substance use and used dual process models, where explicit cognitive processes are modeled as relatively distinct from implicit cognitive processes, to explain and predict substance use behaviors. In this paper we synthesized these two theoretical perspectives to produce an adaptive and cognitive framework for explaining substance use. We contend that this framework provides new insights into the nature of substance use that may be valuable for both clinicians and researchers.

Keywords: life history strategies, dual process models, substance use

Introduction

Researchers have recently applied life history theory to the understanding of human social behavior (e.g., Ellis, Figueredo, Brumbach, and Schlomer, 2009; Figueredo et al., 2005; Rushton, Bons, and Hur, 2008). According to life history theorists, variability in environmental conditions during human evolution contributed to selection for substantial behavioral plasticity (Chisholm, 1993; Hill and Kaplan, 1999; Rushton, 1985). Consistent with this notion, a number of investigators have found variation in the degree to which humans allocate energetic resources to either mating effort or somatic and parental effort (e.g., Brumbach, Figueredo, and Ellis, 2009; Figueredo et al., 2006; Quinlan, 2007; Rushton et al., 2008). Life histories characterized by high levels of mating effort and lower levels of somatic and parental effort have been termed fast life histories, while life histories oppositely characterized have been termed slow life histories (Figueredo and Rushton, 2009). Investigators using this evolutionary perspective have found that prosocial and antisocial behaviors function in behavioral suites adapted to particular environmental...
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conditions, with antisocial behaviors more likely employed by fast life history strategists inhabiting more harsh and unpredictable environments, and with prosocial behaviors more likely employed by slow life history strategists inhabiting more safe and predictable environments (Ellis et al., 2009).

Researchers have also recently applied cognitive science to the understanding of substance use, using dual process models to explain and predict substance use behaviors (e.g., Munafo and Albery, 2006; Redish, Jensen, and Johnson, 2008; Stacy and Wiers, 2006). Dual process models distinguish between implicit processing, which is more rapid and automatic, and explicit processing, which is slower and more deliberate (MacDonald, 2008; Munafo and Albery, 2006). In this paper we synthesize life history theory and dual process models of cognition to produce an adaptive and cognitive framework for understanding substance use. We contend that this framework provides new insights into the nature of substance use that may be valuable for both clinicians and researchers.

Synthesizing Life History Theory and Dual Process Models

Life History Theory and Human Resource Use

Evolutionary biologists originally studied the r/K continuum of reproductive behavior with a focus on between-species differences, with r-selected species investing highly in reproductive effort (e.g., rabbits and fish), and K-selected species investing more in somatic and parental effort (e.g., elephants and humans; Figueredo et al., 2006). In the face of high mortality, r-selected species were observed to invest more resources in the short-term survival of many offspring, while K-selected species invested more resources in the long-term survival of few offspring when relatively few would die, and where investment would increase offspring competitiveness (Geary and Flinn, 2001).

In addition to observing between-species variation in life history, researchers found support for within-species variation in life history strategy (LHS), and Rushton (1985) found support for the proposition that such variation exists in humans. Recent literature addressing human behavior has referred to the r/K continuum of reproductive behavior as the slow-fast life history continuum (e.g., Brumbach et al., 2009; Ellis et al., 2009). Researchers have confirmed many of the predictions of life history theory among humans, linking slow life histories to behaviors such as careful consideration of risks, long-term thinking, and cooperation, and linked fast life histories to behaviors such as risk-taking, short-term thinking, and anti-social behaviors (Ellis et al., 2009; Figueredo et al., 2005).

Life history theory provides a lens for understanding the cooperative and planful use of resources for long-term survival and reproduction, and the uncooperative and more reflexive use of resources for short-term survival and reproduction. The adaptive value of life history strategies appears to be context dependent. Evolutionary life history theorists, Kruger, Reischl, and Zimmerman (2008), indicated that r-selected species (i.e., those with fast life histories) have been associated with unpredictable environments, while K-selected species (i.e., those with slow life histories) have been associated with predictable environments. Humans may have some ability to use facultative strategies adapted to either context (e.g., time perspective; see Kruger et al., 2008). Human cognition may be sensitive to environmental conditions, activating processes and behaviors consistent with slow life

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history strategy in safe and predictable environments, and processes and behaviors consistent with fast life history strategy in harsh and unpredictable environments (Ellis et al., 2009). Indeed, many of the behaviors associated with fast life histories and unpredictable environments are those requiring lesser deliberation, while many of the behaviors associated with slow life histories and predictable environments are those requiring greater deliberation (Figueroedo et al., 2006). Consistent with these notions, Quinlan (2007) found an association between pathogen load and parental investment, and Chisholm (1999) found an association between uncertain environments (e.g., characterized by family conflict) and both earlier ages of reproduction and higher reproductive rates. In addition, Brumbach et al. (2009) found that environmental unpredictability directly influenced life history strategy in a nationally representative sample of young adults, and that environmental harshness indirectly influenced young adult life history strategy.

Dual Process Models of Cognition and Human Resource Use

Forethought can be observed in many achievements prized in Western societies, including skyscrapers that form city skylines, medical technologies that save human lives, and modern agricultural technologies that sustain large human populations. In these cases, forethought has been of great use when relatively large quantities of resources have been acquired and used according to long-term plans. Putting such long-term plans into practice requires agreement among people with respect to goals and the sharing of resources – i.e., planned cooperation. Arguably, many of the values or norms found in modern industrialized societies (Geary and Flinn, 2001; see also Tesser, 1995) reflect some consensus related to the utility of long-term and planned cooperation.

The ability to share resources to achieve valuable outcomes is comprised of many micro abilities. These include (but are not limited to) competencies that underpin social facility, such as communication skills (e.g., assertiveness) and emotional control (e.g., affect regulation or anger management; Rose-Krasnor, 1997; Yucel, Lubman, Solowij, and Brewer, 2007). At another level of analysis, the cognitive mechanisms supporting such competencies can be examined (e.g., implicit processes, explicit processes, working memory, expectancy, and reward; Cunningham, Raye, and Johnson, 2004; Cunningham and Zelazo, 2007; Lieberman, 2004; Margaron, 2004; Stacy and Wiers, 2006; Volkow, Fowler, Wang, Swanson, and Telang, 2007). These cognitive mechanisms are thought to translate factors representing predispositions for behavior into outward behaviors. According to Goldman, Darkes, Reich, and Brandon (2006), cognitive processing translates one’s genetics and environment into expectancies. These expectancies represent the transfer of an organism’s experiences into biological tissue, and this transfer functions to prepare the organism for future encounters with similar circumstances (Goldman et al., 2006). Expectancies contain the value of rewards, along with the probability of achieving them through particular behavioral strategies in future contexts (Higgins and Spiegal, 2004; Redish et al., 2008; Wigfield and Eccles, 2002). Goldman et al. (2006) suggested that expectancy may even be the “functional outcome of epigenesis” (pp. 149).

Expectancies are sometimes formulated quickly, with little deliberation and even without conscious awareness, but are also formulated slowly, with greater deliberation and more penetrating insight (MacDonald, 2008; Redish et al., 2008). Expectancies are
translated into behaviors both automatically (i.e., implicitly) and deliberately (i.e., explicitly; MacDonald, 2008; Munafo and Albery, 2006; Redish et al., 2008). When automatic, human cognition seems to respond better to contexts requiring quick responses to threats or available resources, while deliberative cognition appears to respond better to contexts requiring planful and cooperative responses to such stimuli (Gilbert, 1998).

Research suggests that humans integrate contextually related experiences into expectancy networks, or cognitive schemas (similar concepts include summative memory traces, associative networks, and attitudes; Carbon and Albrecht, 2012; Conrey and Smith, 2007; Goldman et al., 2006; Ross and Hill, 2002; Stacy and Wiers, 2006). Schemas are hierarchically organized representations of context that can be formed and/or activated in the same manner as component expectancies (see above; Stacy and Wiers, 2006). When component expectancies or nodes in a schema or network are activated, the likelihood that other expectancies in that network will be activated is increased (Stacy and Wiers, 2006).

Implicitly or explicitly, incoming sensory information is associated with past experiences stored in memory (Goldman et al., 2006). Expectancies or nodes that are co-activated may comprise schemas, and these schemas may signal whether downstream processing should be implicit or explicit. Ross and Hill (2002) defined unpredictability schema as “a pervasive belief that people are undependable and the world is chaotic”. Unpredictability schema may function to inhibit the association of context with representations of future goals. These schemas may signal that investment of bio-energetic resources into explicit processing and higher-order integration of context and future goals is futile, given that the environment is unpredictable and cognitive models will be unlikely to generalize across contexts or as time passes. Thus, unpredictability schema may trigger facultative reliance on implicit processing, manifested as impulsive and risky behavior. Some empirical support for the above exists. Ross and Hill (2002) conducted a literature review and found that 85% of relevant articles reported links between childhood unpredictability and unpredictability schema or risk-taking propensity. The literature reviewed by Ross and Hill (2002) also linked childhood unpredictability with impulsivity.

**Immediate Survival Focus (ISF)**

Natural selection may have selected for the mechanisms supporting implicit cognitive processes as a function of their contribution to fitness (i.e., reproduction) in generally unpredictable or harsh contexts where a fast life history would most likely be adaptive. Conversely, the mechanisms supporting explicit processes may have been selected for as a function of their contribution to fitness in generally safe and predictable contexts where a slow life history strategy would most likely be adaptive. In other words, nature may have retained variation in the automaticity or deliberativeness of cognition because human environments have been variable in their predictability and safety. Thus, individuals characterized by harsh unpredictable environments and fast life histories may rely more heavily on implicit cognitive processes, while those who are characterized by safe predictable environments and slow life histories may rely more heavily on explicit processes.

As suggested above, adaptation to unpredictable and unsafe environments may be associated with a greater reliance on implicit or automatic cognitive processing. This
reliance on implicit processing may contribute to frequent false positives in the detection of resources and threats critical to survival and reproduction. Such misdetection may have been selected for in ancestral human environments (i.e., environment of evolutionary adaptedness; Mealey, 2000) that were unpredictable and dangerous, where the cost of a failure to detect limited resources or imminent threats would have outweighed the cost of false positives (i.e., a smoke detector effect; Nesse and Williams, 1996; and see Gilbert, 1998). This Immediate Survival Focus (ISF) in cognitive processing may be maladaptive in modern societal contexts, functioning to support fast LHS and contribute to high-risk behaviors such as substance use.

According to this explanation, average or trait automaticity in cognitive processing does not vary primarily as a function of intelligence or exposure to stimuli that were recurrent or non-recurrent over evolutionary time (see MacDonald, 2008). Instead, average reliance on implicit processing is thought to vary as a function of general environmental conditions (e.g., unpredictability or harshness) or genetic propensity toward implicit or explicit processing. Consistent with these notions, researchers recently reported that life history strategy was statistically independent of intelligence (Gladden, Figueredo, and Jacobs, 2008; Sefcek, 2007), and that general environmental conditions influenced life history strategy over time in a national sample of adolescents and young adults (Brumbach et al., 2009). In addition, Figueredo, Vásquez, Brumbach, and Schneider (2004) found that life history strategy was about 60% heritable.

This argument does not ignore the modulation of implicit processing by recurrent and evolutionarily old threats and resources (e.g., snakes, heights, or secondary sex characteristics among potential mates; Gilbert, 1998; MacDonald, 2008). However, these recurrent stimuli are also frequently the focus of explicit cognitive processing. Thus, this article places emphasis on the distinction between conditions in which immediate responses to resources and threats were adaptive, and those which favored future responses to stimuli. That is, regardless of intelligence or the recurrence of resources or threats over evolutionary time, environmental unpredictability and harshness would have influenced the extent to which immediate responses to stimuli were adaptive. Because intra-generational variation in environmental predictability and harshness would have been typical during human evolution, facultative use of either implicit or explicit processing would have likely contributed to reproductive success.
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**Figure 1.** Immediate Survival Focus (ISF) in Cognitive Processing

- **Safety and Predictability**
  - Careful consideration of risks
  - Long-term thinking/planning
  - Prosocial behaviors
  - Satisfying relationships
  - Mental & physical health
  - Parental investment
  - Higher earning potential

- **Explicit Processing**
  - Impulsivity
  - Risk-taking
  - Short-term thinking
  - Aggression
  - Intimate partner violence
  - Substance abuse
  - Delinquency
  - Lower earning potential

- **Danger and Unpredictability**

**Note:** LHS refers to life history strategy. Some of the constructs in the graphic have not yet been introduced – these will be addressed later.

**ISF and Substance Use**

Researchers in the area of addiction science have identified various factors that predict level of substance use. These factors include heritable (e.g., sensation seeking), niche (e.g., delinquent peer group), and environmental risk factors (e.g., family conflict; Kendler, Prescott, Myers, and Neale, 2003; Kilpatrick et al., 2000; Nation and Hefflinger, 2006; Nesse, 1994; Stoel, Geus, and Boomsma, 2006; Whiteside and Lynam, 2001). Additionally, researchers in the area of cognition and addiction have found that attention and processing biases differentiate those high in substance use from those low in such, and also predict level of use over time (Field, 2006; McCusker, 2001, 2006; Stacy and Wiers, 2006). These cognitive biases are thought to arise as substances are experienced as favorable and habitually used (McCusker, 2001, 2006).

While it is understood that heritable, environmental, and niche-related risk factors contribute to the level of substance abuse, little is known about the mechanisms supporting the relationships between these risk factors and the biases in expectancy, attention, and cognitive processing characteristic of those high on substance use (Munafo and Albery, 2006). ISF may translate these heritable and environmental risk factors into choice of niche.
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and cognitive biases for substance related stimuli. ISF would contribute to false positives in the detection of resources and threats critical to survival and reproduction, and in this context substances would be experienced as critical resources or the escape of critical threats. Once substances are identified as critical to survival and reproduction, ISF would contribute to the maintenance of behaviors aimed at their acquisition and consumption. In other words, ISF would increase the likelihood that substances are tagged as critical resources or threats, and also contribute to the formation of habits that support their compulsive acquisition and consumption. ISF would support compulsive acquisition and consumption of substances because critical resources must be pursued and critical threats must be avoided.

Life History Strategy (LHS) and Substance Use

Evolutionary theory generally views problematic use of substances as a fundamental human tendency to be managed, rather than a disease to be cured (Nesse, 1994). Drugs, as primary reinforcers, manipulate our basic affective systems, giving rise to the experience of acquisition and consumption of essential resources, or to the experience of escape of threat (Goldman et al., 2006; Margaron, 2004; Nesse, 1994). When viewed through the lens of evolutionary theory, substance use, while having many unique characteristics, is seen as comparable to the acquisition and consumption of other resources that are essential to survival, such as food, and to the avoidance and escape of threats such as social rejection (Nesse, 1994).

The rationale for viewing problematic substance use as a human tendency to be managed stems from the dependence of the related behaviors on the same mechanisms that rendered our ancestors successful reproducers (Nesse, 1994). In other words, our ancestors successfully accomplished species typical goals that facilitated reproduction, and some of the mechanisms by which these goals were accomplished are the same that render us vulnerable to higher levels of substance use. Over millennia, nature retained various components of the human brain as a function of their relationship to the reproduction of the organism. Today, some of the components that contributed to our ancestors’ fitness are basically tricked into evaluating drugs as favorable to survival and/or reproduction, and into initiating and maintaining goal directed behaviors designed to approach and consume substances. For example, Goldman et al. (2006) indicated that:

Alcohol works on the system for tagging stimuli as biologically significant (via direct effects on the dopamine system, i.e. ‘incentive salience’), and on emotional/motivational systems, to make these memories more indelible and salient, and thereby more influential within the overall decision-making process that leads to (or is avoidant of) alcohol use. (pp. 164-165)

Because substances are primary reinforcers, it might be reasonable to predict that substance users expect to achieve species typical goals through their acquisition. Fromme, Stroot and Kaplan (1993) found that substance users reported positive expectancies including, but not limited to, increased sociability (e.g., more outgoing and energetic), liquid courage (e.g., more courageous, daring, brave, powerful, and creative), and sexuality (e.g., better lover, enjoy sex more, be sexier, could act out their fantasies). In addition,
Klinger and Cox (2004) found that current concerns of alcohol users could be seen as representing concern over resource acquisition and relationship goals. Thus, substance use may be seen as a means to some ends typical of the human species.

The benefits of consuming substances seem to be rather short-term (e.g., positive affect), while costs to health and other aspects of human functioning are accrued over time and as frequency and severity of consumption increase (CASA, 2005; McCusker, 2006; ONDCP, 2004). Further, there is substantial evidence indicating that those characterized by high levels of substance use have short-term time horizons, or time perspectives (Adams, 2009; Peters, Jr. et al., 2005; Petry, Bickel, and Arnett, 1998; Robbins and Bryan, 2004; Zimbardo and Boyd, 1999). As substances seem to provide the experience of short-term acquisition and consumption of resources (e.g., via positive affect, expectancies, etc.), it might be feasible to expect that those high on substance use are also high on fast life history strategy (fast LHS) and characterized by genes, early environments, and niches that are associated with short-term survival and reproduction.

Substantial empirical support for the above exists. Heritable differences in sensation seeking, or optimal level of stimulation, represent a genetic basis for the employment of short-term survival strategies (Stoel et al., 2006; Zuckerman, 1996). Sensation seekers are often characterized by problematic substance use, affect-based decision making (i.e., impulsivity), and risky behaviors, all of which contribute to mortality (Laub and Vaillant, 2000; Robbins and Bryan, 2004). Research has also suggested that individuals high on substance use are characterized by lower quality parental relationships, lower family cohesion, and greater family hostility (Nation and Heflinger, 2006). Hill, Ross, and Low (1997) indicated that such environmental unpredictability and risk may inhibit delay in behavioral patterns related to reproduction. Related, Nation and Heflinger (2006) reported associations between substance use and niches characterized by antisocial peers and delinquent and aggressive behaviors. Researchers recently reported that fast LHS subsumed substantial variance in many reliable correlates of substance use, including impulsivity (Brumbach et al., 2009; Figueredo et al., 2005, 2006); time orientation or preference (Chisholm, 1999; Ross and Hill, 2002); psychosocial stress and insecure attachment (Del Giudice, 2009; Ross and Hill, 2002) early sexual debut, pregnancy, and greater mating effort (Ellis et al., 2009; Figueredo et al., 2005, 2006; Hill and Kaplan, 1999); lower parental investment (Ellis et al., 2009; Figueredo et al., 2005, 2006; Geary and Flinn, 2001); family conflict and intimate partner violence (Figueredo et al., 2006; Figueredo, Gladden, and Beck, 2011); and delinquency (Ellis et al., 2009; Figueredo et al., 2006; Gladden, Welch, Figueredo, and Jacobs, 2009). Finally, Hill and Chow (2002) found that life history theory was able to explain variation in risky drinking, just as it has explained variation in other risky behaviors. Thus, it seems there is some indication that individuals high on substance use are characterized by genes, early environments, and niches consistent with fast LHS.

**Implicit Cognition and Substance Use**

The distinction between implicit and explicit processes has provided insight into many areas of psychological science, including the formation of habits, the construct
validity of self-report measures, and the great difficulty in behavior change (Munafo and Albery, 2006). Researchers have found that substance related stimuli engage implicit processes in those high on substance use, while no comparable response is observed in controls (Field, 2006). It appears that repeated use of substances is associated with a shift from the use of deliberate behavioral control to automatic behavioral control (i.e., habit formation; see McCusker, 2006; Redish et al., 2009). This finding led to research shedding light on the puzzling inability of expectancies to reliably predict relapse (for a review see McCusker, 2006). Specifically, in samples of participants in treatment for problematic substance use, the number of negative expectancies related to substances was not significantly associated with relapse. Using tests of implicit processes, researchers found that though individuals high on substance use reported more negative expectancies than controls, their positive expectancies were accessed faster than their negative expectancies (McCusker, 2001, 2006). Negative expectancies related to substances, in those high on substance use, were more slowly accessed through deliberation. Thus, those high in substance use seem to carry out the related behaviors using automatic cognitive processes.

Other support for the notion that implicit processes underpin higher-level substance use comes from research on impulsivity. Either deficiency in higher-order processing or overactive implicit processes may be associated with aspects of impulsivity (i.e., disinhibition; Vigil-Colet and Codorniu-Raga, 2004). In either case, a reliance on implicit cognition might be observed. Allen, Moeller, Rhoades, and Cherek (1997) noted a robust association between impulsivity and substance use. Conversely, Bogg and Roberts (2004) indicated that conscientiousness, or the degree to which one is deliberative, has been observed to have a negative relationship with substance use.

As insinuated, researchers have experienced difficulty identifying whether it is hyperactive implicit processes or underactive deliberative processes (i.e., executive control deficits) that are related to impulsivity. In the absence of brain injury or fMRI data, the two possible mechanisms supporting impulsivity are often indistinguishable. Social neuroscientists have found that to a substantial extent, implicit and explicit processes are activated in a mutually exclusive manner (Lieberman, 2007). For example, biologically relevant pictures may take an evolutionarily old shortcut to the limbic system, and at times explicit processes may inhibit implicit processes (e.g., take control of the habit system; Lieberman, 2007; van Honk and Schutter, 2007).

An Evolutionary and Cognitive Framework

Fast LHS seems to characterize both the behavioral strategies employed and contexts inhabited by individuals high on substance use. The environments survived by our ancestors (i.e., EEA) would have at times been characterized by greater resource scarcity and more threatening social environments. During these periods, long-term survival was more uncertain and shorter-term strategies for survival and reproduction may have been more adaptive. At the level of cognition, such a focus on short-term survival and reproduction might have implied a heavier reliance on implicit cognitive processes, which are adapted to quick evaluation and behavioral execution. Today, this ISF in cognitive processing may increase vulnerability to problematic substance use by contributing to false
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positives in the detection of resources and threats critical to survival and reproduction. Such vulnerability might be underpinned by the effects of substances on mechanisms that support implicit evaluation of the biological significance of stimuli. That is, substances would be more frequently evaluated as biologically critical by individuals relying on implicit processing in response to unfavorable environmental conditions.

Discussion

ISF and Risk for Problematic Substance Use

ISF may link risk factors for problematic substance use with the cognitive biases characteristic of those high on substance use. This synthesis introduced the notion that cognition responds to indication that long-term survival is improbable (e.g., low parental investment or attachment, low environmental predictability, neighborhood danger, unpredictability schema, etc.) by becoming more automatic in support of short-term survival and quicker reproduction. ISF is characterized by a relatively high error rate in the evaluation of possible resources and threats critical to survival because it trades evaluative accuracy for speed. In this context substances are quickly evaluated and tagged as either resources critical to survival or as the escape of critical threats. Reflection upon substance use is inhibited by ISF and habit formation is initiated. Due to ISF, substance use becomes quickly controlled by the habit system, becoming automatically initiated with a fixed value (see Redish et al., 2008). Cognitive bias for substance related stimuli is now well-established, and individuals high on substance use find great difficulty in inhibiting behaviors associated with exposure to substance-related cues (McCusker, 2006; Munafo and Albery, 2006).

The discussion above sheds light on several aspects of problematic substance use that are little understood. First, ISF provides an explanation of the dichotomous thinking often observed and reported by substance abuse counselors (see Beck, Wright, Newman, and Liese, 1993). ISF implies that individuals high on substance use are using implicit processes to quickly identify critical resources and threats. As a result, many of their evaluations could be expected to produce black-or-white beliefs, or beliefs that objects are critically good or bad (i.e., absolutely good or bad). ISF, supported by implicit processes, also provides insight into the curious tendency of individuals high on substance use to be both impulsive and compulsive (Torregrossa, Quinn, and Taylor, 2008; Whiteside and Lynam, 2001). At the same time that such substance users are pursuing critical resources or avoiding critical threats, they can be observed to make very quick or impulsive decisions. If impulsivity is a behavioral trait associated with a reliance on quick and automatic processing, and compulsivity represents the pursuit or avoidance of critical resources or threats identified by such processing, then the umbrella of ISF covers both traits.

This synthesis introduces the notion that, given certain risk factors, substances are likely experienced as the acquisition of critical resources or the escape of critical threats due to ISF. This experience of substances may correspond to reality to the extent that it is useful to individuals. That is, the notion that substances are of illusory benefit may be one that is limited to those employing slow LHS in safe or predictable environments – substance use does not seem to facilitate long-term attempts at survival and reproduction.
Substances may be considered real resources for survival and reproduction by those attempting short-term reproduction in unpredictable environments because they may actually facilitate such reproductive attempts. This may be especially true among male fast life history strategists. Indeed, some preliminary evidence suggests that substance use has facilitated mating success. Richardson, Chen, Dai, and Swoboda, in prep) fit a panel structural equations model to four waves of data (two year lags) from the National Longitudinal Survey (Bureau of Labor Statistics, 2005) and found that prior substance use predicted number of sexual partners over and above both proximate substance use and prior number of sexual partners. This study extended upon recent research that linked number of sexual partners with both initiation and intensity of substance use (Cavazos-Rehg et al., 2011).

**Prevention, Diagnosis, and Treatment**

Many humans today find themselves in relatively safe environments with plenty of resources. In such environments, ISF may present an obstacle to the health and longevity that is available to individuals. Inhibition of ISF and facilitation of the use of slow life history strategy may often be warranted in such contexts. From the current perspective, those with substance use disorders (SUDs) are confronted in treatment with the challenges of (1) letting go of (i.e., reevaluating) critical resources and threats, (2) giving up working short-term strategies for longer-term strategies they have not tested, (3) succeeding at 1 and 2 in the face of the lingering experience (implicit or explicit) that long-term survival is of low probability, and (4) inhibiting the implicit processing of substance-related stimuli.

ISF provides insight into the resistance of those with SUDs to information suggesting they have a problem. Because these individuals may have the experience of acquiring critical resources and avoiding critical threats, they may be experiencing – explicitly or implicitly – success in an attempt at surviving and reproducing. Informing individuals with SUDs of the higher probability of death inherent in their strategy may do little to cause panic because ISF and the associated strategies were selected for their success in the face of the correlates of death (phrase taken from Chisholm, 1993). Resistance to change among individuals high on substance use may stem not only from habit, but also from fear of relinquishing a potentially successful strategy in favor of a strategy that is untested. This fear would be enhanced by the effects of past experiences with environmental harshness and unpredictability that indicate a slow life history strategy would likely cost too much from the perspective of Darwinian fitness.

This evolutionary and cognitive perspective on substance use may inform prevention and treatment interventions by providing a survival and reproductive context for understanding the experiences of individuals with SUDs. This context could be used to identify and address barriers to treatment, such as the experience that substances are critical to survival and reproduction. Related, this evolutionary and cognitive framework provides a way for problem substance users to understand their own experiences with substance use. Clinicians could use this framework to teach clients that (1) life history strategy falls along a spectrum from fast to slow, and (2) their past experiences of the value of substances, substance focused friendships, substance focused intimate partnerships, etc., have been a function of their position on the life history spectrum. This framework might be a nice
addition to harm reduction approaches (see Marlatt, Larimer, and Witkiewitz, 2011).

Substances could be understood as harmful to the extent that individuals wish to pursue a slow life history strategy. For those wishing to pursue a slow life history strategy, life history theory and ISF represent tools for critically evaluating whether or not substances are critical to survival and reproduction. Treatment seekers can use these tools to arrive at answers to the questions: Why do substances seem really good? And, why might my subjective experience of substances be inaccurate? Because substances are experienced as such potent rewards, they may provide the experience that successful reproduction is in hand. This subjective experience of substances may or may not be accurate in the context of a fast life history strategy, but this experience is likely inaccurate in the context of a slow life history strategy.

When combined, life history theory and ISF could provide individuals with an abacus for “calculating” the value of substances given their circumstances. An individual could also use this abacus to calculate the value of substances given hypothetical circumstances they would like to create for themselves. If one wants to find oneself far to the slow end of the life history spectrum (i.e., accumulating resources, living a relatively long life, investing heavily in children and/or relatives, and experiencing less psychological pain), are substances critical given this goal? And if not critical, how valuable are they? Given a finite quantity of resources, how does the individual wish to invest? It is important to note that this evolutionary perspective does not imply the objective value of a slow life history strategy or suggest that reproduction is objectively valuable. Rather, it acknowledges our evolutionary heritage and makes use of theories and evidence regarding evolved mechanisms that underpin variation in our behaviors. Perhaps life history education could augment existing psychotherapeutic and medical treatments for SUDs by helping individuals contextualize their use of substances. Such education might prove especially useful in helping clients resolve ambivalence regarding their use of substances and their treatment goals.

There is still no “gold standard” for identifying addictions, and our diagnoses and definitions remain tautological in their reliance on sequalae (Shaffer, 2012, pp. xxvii-li). Assessing whether individuals are characterized by ISF might aid in prevention and treatment efforts, as ISF may be a reliable precursor to addiction. The general term “addiction” is used here because ISF would likely increase the probability that both substance and non-substance stimuli would be identified as critical to survival and reproduction. Therefore, assessment of ISF may aid in the prevention and treatment of “process” addictions (i.e., addictions to gambling, food, or sex) as well as substance ones. In addition to assessing for ISF, assessment of whether individuals have actually identified substances or other stimuli as critical to survival and reproduction may represent a potential criterion for the diagnosis of addictions. Such assessment might enable researchers and clinicians to move beyond tautology. At the very least, research guided by the current evolutionary and cognitive framework may help to explicate such a criterion. Toward this end, efforts to validate self-report measures of ISF and whether substances have been identified as critical are currently under way.

**Related Constructs and Future Directions**

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This article is intended to stimulate interest in the possibility that ISF serves as a mechanism linking environmental risk factors with risky behaviors such as substance use. This notion can be subjected to empirical tests. Tests of the existence of the construct could initially be carried out along three lines. First, researchers could test if a single latent construct theorized to represent false positives in the detection of resources and threats critical to survival and reproduction links environmental unpredictability and harshness to substance use, LHS, and constructs known to rely on implicit cognitive processing. Second, researchers could use measures of implicit cognitive processing to index trait use of implicit processing (e.g., ecological momentary assessment). This index could then be tested for links to environmental conditions, false positives in the detection of critical resources and threats, problem behaviors, and LHS. Finally, a self-report measure could be developed to assess susceptibility to false positives in the detection of critical resources and threats, and possibly reliance on implicit processing. If a reliable and valid self-report measure of ISF were developed, it could be linked to the other constructs noted above.

Related to the first potential line of research, several constructs could be used to extract the latent factor representing ISF. ISF has been theorized to have effects on manner of resource acquisition and manner of dealing with threats. ISF would therefore be expected to subsume substantial variance in both externalizing constructs such as substance use and aggression, and also internalizing constructs such as neuroticism or submission motives (Figueroedo et al., 2005; Griffith et al., 2009; Kendler et al., 2003; MacDonald, 1995; Nobile et al., 2007; van Honk and Schutter, 2007). The results of a number of studies currently suggest that implicit processing supports substance use, aggression (or the implicit dominance motive), and submissiveness (or the implicit submission motive; see Munafo and Albery, 2006; Putman, Hermans, and van Honk, 2004; van Honk and Schutter, 2007). In addition, a negative relation might be expected between prosocial or cooperative behavior and ISF, as implicit processing is known to operate to the relative exclusion of explicit or higher-order processing (Lieberman, 2007).

ISF may also be extracted from constructs such as impulsivity and compulsivity. Associations between impulsivity and both aggression and substance use have been observed (Allen et al., 1998; Vigil-Colet and Codorniu-Raga, 2004). In addition, compulsivity has been linked to substance use, where compulsive behaviors are those which individuals are unable to inhibit (Torregrossa, Quinn, and Taylor, 2008). Within this theoretical framework, impulsivity and compulsivity could be considered as behavioral traits underpinned by the cognitive construct – ISF.

Finally, the K-factor, or slow life history, could subsume the variance in the constructs theoretically linked to ISF. The K-factor has been linked to some forms of aggression, victimization, and prosocial behavior (Ellis et al., 2009; Figueredo et al., 2005, 2006; Kruger et al., 2008). However, the K-factor would need to be a cognitive construct to fit into the present theoretical framework. To our knowledge, this possibility has not been ruled out. The K-factor may very well represent the principle of expectancy in what Goldman et al. (2006) suggested may be the “functional outcome of epigenesis” (pp. 149). That is, cognition may function to anticipate, implicitly or explicitly, what combination of circumstances and strategies will best lead to reproduction, combining the optimal strategies and contexts. High K individuals would have predicted that waiting is optimal for
reproduction, while low K individuals would have predicted that waiting is too risky or provides little or no reproductive benefit. Low K individuals would be characterized by ISF in cognitive processing and frequent false positives in the detection of critical resources and threats. Cognition may link genes and environments to LHS over time, but this remains a question for future research, although recent studies have found support for the possibility that executive functions play such a role (Figueroedo et al., 2011).

This article was written for the purpose of stimulating interest in a cognitive link between general environmental conditions and maladaptive behaviors (i.e., behaviors that are thought to be maladaptive in post-industrial contexts). In addition, this work was intended to stimulate more interest in dual process models and life history theory, especially in the context of research on substance use. As mentioned, there is still no “gold standard” for identifying addictions (Shaffer, 2012, pp. xxvii-li). Research on the assessment of whether individuals have identified substances or other stimuli as critical to survival and reproduction could lead to a criterion for the diagnosis of addictions. We hope this article will interest researchers in using the approaches introduced to develop an ISF as a target for the prevention, diagnosis, and treatment of problematic substance use and addictions, ultimately helping to reduce the associated harm to individuals, families, and societies.

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