



Relations Between the Behavioral Approach System (BAS) and Self-Reported Life History Traits

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Abstract: The behavioral approach system (BAS) has been shown to be important in everyday life. However, its putative evolutionary origins have not been extensively studied. The purpose of this study was to explore relationships between BAS processes and life history strategies, or lifestyles, within life history theory. The BAS scales were assessed by the Reinforcement Sensitivity Theory of Personality Questionnaire (RST-PQ) and Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ-20), while lifestyles were measured by the Mini-K. Data from 457 participants (173 males) were analyzed by structural equation modelling, followed by set correlation to examine personality and Mini-K relationships. The structural model showed that RST-PQ Reward Interest, Goal-Drive Persistence and Reward Reactivity correlated with a slow lifestyle, while RST-PQ Impulsivity and (SPSRQ) Sensitivity to Reward (SR) did not correlate with the Mini-K. However, set correlation analysis revealed that SR correlated negatively with the Mini-K subscale Experience in romantic relationship and highlighted the importance of Insight, planning, and control in explaining the role of the BAS within slow lifestyle strategy. The findings are discussed in terms of possible evolutionary origins of the BAS.

Keywords: reinforcement sensitivity theory, evolution, life history theory, behavioral approach system

Motivation psychology is concerned with two main questions: the *what* and the *how* of the direction and strength of behavior (Kruglanski, Chernikova, & Kopetz, 2015). The *what* represents the list of motives that people perceive as attractive, and the *how* focuses on the fundamental processes of attaining motives from the list. Also, there is another question that has been less studied: *Why* certain motives are more important than others, and what are their functions? Moreover, are there specific processes that serve to attain specific motives? Answers to those questions lie in the field of evolutionary psychology.

People have different needs and desires, that is, they differ in *what* they want and *how* strongly they want it (Baumeister, 2016). In general, individual differences are interpreted by evolutionary psychology as variations in adaptive mechanisms that evolved to provide solutions to problems, especially regarding reproduction and survival (Buss, 2008). It is assumed that organisms are equipped with genetically encoded strategies that manifest differently in various environmental conditions. This flexibility ensures maximization of expected fitness (Hagen & Hammerstein, 2005). In this study, we explore the evolutionary origins

of resource acquisition strategies that enable adjustment to environmental conditions and, therefore, enhance the chance of gaining resources relevant for survival and reproductive success. In this paper, we try to link the *how* with *what* aspect of motivation, and to provide the *why* of these links.

Approach Motivation

Among others, appetitive or approach motivation is assumed to reflect a resource acquisition mechanism (Kenrick & Shiota, 2008). One of the most studied approach/avoidance motivation traits is the behavioral approach system (BAS), which is one of the systems within reinforcement sensitivity theory (RST; Corr, 2008). This neuropsychological personality theory proposes the existence of three brain-behavioral circuits, which represent general emotional-motivational systems: BAS representing approach, and the behavioral inhibition system (BIS) and fight-flight-freezing system (FFFS) representing defensive systems (Corr, 2008; Gray & McNaughton, 2000). This study focuses only on a part of the theory, that concerning the BAS.

The BAS is defined as a brain-behavioral system that mediates reaction to cues of reward and non-punishment, and its primary function is to move an organism up the temporospatial gradient (Gray & McNaughton, 2000). The BAS decomposes its primary function from a start state (e.g., the idea of, or the physical distance to a source of food) toward the final biological reinforcer (e.g., consumption of food) into four intertwined processes: (a) identification of the biological important resource; (b) planning on how to attain the resource; (c) execution of the plan (consummation); and lastly, (d) activation of a pleasure system following attainment of the resource that should maintain motivation for attaining the resource in the future (Corr, 2008, 2013; Corr, DeYoung, & McNaughton, 2013). Each of these stages plays an important role in obtaining resources. In recent developments of RST psychometric instruments, these processes are operationalized as: Reward Interest, reflecting identification of the biological reinforcer; Goal-Drive Persistence, encompassing planning behavior; Impulsivity, reflecting fast reaction at the final stage of execution of the plan; and Reward Reactivity, representing emotional (and self-reinforcing) reactions on receiving the reward (Corr & Cooper, 2016). The purpose of this study is to explore the importance of these functions in attaining certain types of goals.

Several authors have discussed the role of the BAS from an evolutionary psychological perspective. For instance, MacDonald (1995, 2012) postulated the existence of two broad types of the BAS: Dominance/Sensation Seeking and Nurturance/Love. They presented two qualitatively different aspects of the same system. The former describes the impulsive part of extraversion, concerned with establishing social dominance, surgency, and aggression, while the latter describes a mechanism of establishing supportive social network through maintaining good relationships in the social environment. Later psychometric studies confirmed the existence of two conceptually similar subtypes of the BAS. Depue (2006) describes MacDonald's (1995) Dominance/Sensation Seeking and Nurturance/Love under labels "agency" and "affiliation," respectively. Affiliation reflects enjoying and valuing close interpersonal bonds, while Agency reflects social dominance, enjoyment of leadership roles, assertiveness, and a subjective sense of potency in accomplishing goals. A similar perspective has been offered by DeYoung, Quilty, and Peterson (2007) extracting two correlated subfactors within Extraversion: Assertiveness and Enthusiasm. Assertiveness encompasses traits related to drive, leadership, and dominance; and Enthusiasm encompasses both outgoing friendliness or sociability and the tendency to experience and express positive emotion.

In line with the above research findings, a recent study (Krupić, Gračanin, & Corr, 2016) showed the different roles

of BAS subscales in predicting two kinds of resource acquisition strategies, namely cooperation and competitiveness. Specifically, Goal-Drive Persistence and Reward Reactivity were associated exclusively with cooperation; Impulsivity with competition; while Reward Interest was not exclusively related to one particular strategy – the latter factor correlated with exploring the environment, participating in competitions that signal gender-appropriate physical ascendancy, caring for relatives, and with reciprocation among nonkin. Goal-Drive Persistence was related to social exchange, while Reward Reactivity with tendency of nurturing intimate relationships. These findings showed the importance of the BAS processes in the two broad evolutionary domains.

To sum up, a growing body of evidence suggests that the BAS has two broad functions: one primarily concerned with resource acquisition and the second oriented towards the social environment. In this study, we examine how the BAS functions correlate with life history theory (LHT) continuum.

Life History Theory (LHT)

The LHT represents an evolutionary-economic framework to study the optimal allocation of bioenergetic and material resources (Sherman, Figueredo, & Funder, 2013). An organism distributes available resources between somatic effort (growth, maintenance, and development) and reproductive effort (Geary, 2002). From the LHT perspective, fundamental trade-offs are made between current and future reproduction, between quality and quantity of offspring, and between mating and parenting effort (Del Giudice, 2014a).

Life History Theory uses the fast-slow continuum for explaining differences between species (Del Giudice, Gangestad, & Kaplan, 2015). Species with "slow" life history strategy have late maturation and reproduction, characterized by slow growth, large body size, few offspring, long lifespan, and high investment in offspring. In contrast, "fast" species are characterized by early maturation and reproduction, faster growth, smaller body size, more offspring, shorter lifespan, and lower investment in offspring quality (Figueredo et al., 2005). As a species, humans fall at the "slower" end of continuum (Kuzawa & Bragg, 2012).

The LH continuum also applies to a number of personality traits. The "fast" individuals are perceived as more exploitative/antisocial, bold, active, aggressive, less sociable, impulsive, prone to risk-taking, and dominant (Del Giudice, 2014a; Réale et al., 2010; Sih & Del Giudice, 2012; Wolf, van Doorn, Leimar, & Weissing, 2007), while the individuals at the "slow" end of continuum perceive themselves to be more agreeable, conscientious, and honest (Del Giudice et al., 2015).

There is a limited amount of energy or resources that an individual can absorb from the environment for his/her survival and reproduction during a lifetime. Generally, evolution favors individuals that most efficiently allocate limited resources in their distal genetic interests of reproduction and survival (Kaplan & Gangestad, 2005). It has been shown that psychological traits and behaviors related to slow life history strategy (such as maintaining close relationships with friends, parents, and partners; or long-term planning and persistence in goal-achieving) load on a modestly heritable general factor ($h^2 \sim 0.65$; Figueredo, de Baca, & Woodley, 2013; Figueredo, Vásquez, Brumbach, & Schneider, 2004). However, the expression of those traits tends not to be genetically fixed. Environmental conditions (such as predation or diseases) highly influence the adaptiveness of the two lifestyles (Ellis, Figueredo, Brumbach, & Schlomer, 2009; Quinlan, 2007). For instance, in harsh environmental conditions, in order to maximize reproductive success it is more adaptive to start mating early and have low parental investment. These environmental factors in early childhood may shape the development of personality traits (see Simpson, Griskevicius, & Kim, 2011). For example, low parental investment, such as father absence, is related to adopting faster life history strategy in puberty (e.g., Ellis, 2004). Individuals that have grown under uncertain environmental conditions tend to increase the quantity of offspring, by having earlier sexual intercourses and less stable romantic relationships. In contrast, slow lifestyle strategy may seem more adaptive in relatively predictable environments with low-risk mortality resulting in high parental effort, restricted sociosexuality, and prosocial/cooperative behaviors. Thus, both the genetic and environmental factors can shape the LH continuum, which in addition is important in psychological development of an individual.

Present Study

The aim of the present study is to examine relationships between fast life history lifestyle and the BAS function oriented exclusively to resource acquisition, and slow lifestyle with the BAS function oriented toward maintaining social relations. Based on a previous study of Krupić, Gračanin, et al. (2016) we expected that Impulsivity should reflect “fast” lifestyle, while Reward Reactivity and Goal-Drive Persistence should reflect “slow” lifestyle. In other words, we expected that “fast individuals” should score lower on Goal-Drive Persistence and Reward Reactivity, and higher on Impulsivity, and vice versa for “slow individuals.” In order to capture all aspects of the BAS functioning, the Reinforcement Sensitivity Theory of Personality Questionnaire (RST-PQ; Corr & Cooper, 2016) and Sensitivity to

Punishment and Sensitivity to Reward Questionnaire (SPSRQ-20; Aluja & Blanch, 2011) were used. In our recent study (Krupić, Corr, Ručević, Križanić, & Gračanin, 2016), we compared five RST questionnaires. We extracted four BAS components. The only questionnaire that covers all four variants of the BAS scales is the RST-PQ. The SPSRQ in original version has shown many problems with construct validity, so Aluja and Blanch (2011) constructed a short version to improve its construct validity. The second reason for inclusion of the SPSRQ-20 is that the SR and RST-PQ show some dissimilarity. Namely, the SR focuses more on behavioral, while Impulsivity on cognitive aspect of impulsivity.

Methods

Participants and Procedure

Four hundred and fifty-seven (173 male and 284 female) participants ($M_{age} = 31.51$; $SD_{age} = 9.24$) completed the three questionnaires online using Google Form web application. The Ethical Committee of Faculty of Humanities and Social Science in Osijek gave the approval for this study.

Measures

The RST-PQ (Corr & Cooper, 2016) contains four BAS scales: Reward Interest; Goal-Drive Persistence; Reward Reactivity; and Impulsivity. All items are answered on a 4-point Likert scale. The Sensitivity to Punishment and Sensitivity to Reward Questionnaire - 20 (SPSRQ-20; Aluja & Blanch, 2011) contains ten dichotomous items with yes/no response format.

The Mini-K questionnaire is a 20-item single-scale measure of behavioral and cognitive aspects of life history strategies (Figueredo et al., 2006), based on the more comprehensive Arizona Life History Battery (ALHB; Figueredo, 2007). Figueredo, de Baca, and Woodley (2013) recommend the use of this 20-item short-form when the principal focus of the research is not life history, per se, while the full 199-item Arizona Life History Battery should instead be used in studies primarily focused on life history strategy. Anyhow, the Mini-K correlates very highly with the ALHB (Olderbak, Gladden, Wolf, & Figueredo, 2014), showing that it represents a comprehensive measure of LH continuum. CFA model displayed on the left side of Figure 1 showed that the Mini-K scores can be used to represent the LHT on lower and general level. At the lower level the Mini-K contains *Insight, planning, and control, Mother/father relationship quality, Experience in close relationships, Family social contact and support, Friends social*

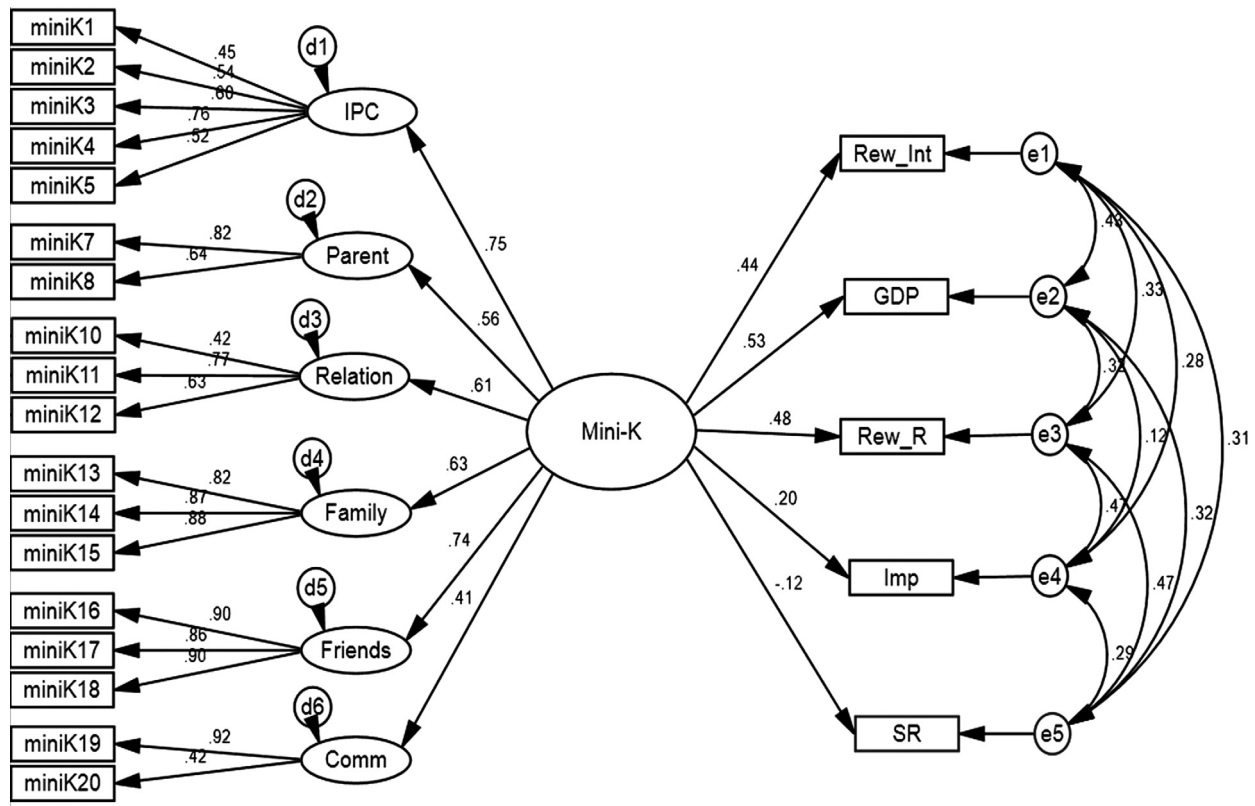


Figure 1. Relationship between general score of the Mini-K and the BAS scales. IPC = Insight, planning, and control; Parent = Mother/father relationship quality; Relation = Experience in close relationships; Family = Family social contact and support; Friends = Friends social contact and support; Comm = Engagement in community; RewInt = Reward Interest; GDP = Goal-Drive Persistence; Rew_R = Reward Reactivity; Imp = Impulsivity; SR = Sensitivity to Reward.

contact and support, and Engagement in community. Details of the CFA results are provided in the Electronic Supplementary Material, ESM 1. Participants responded on a 7-point Likert scale with higher scores reflecting slower lifestyle.

Results

Descriptive statistics, reliability coefficients, and correlations between LHT and BAS variables are presented in Table 1. Cronbach's α reliability coefficients for the Mini-K, Reward Interest, Goal-Drive Persistence, and Reward Reactivity were above .80, while for the SR and Impulsivity were .68 and .69, respectively. Relationships between Mini-K and the BAS scales were examined by the structural model presented in Figure 1. The examined model achieved acceptable goodness of fit indices; $\chi^2(213) = 531.12$, $\chi^2/df = 2.49$, CFI = .89, RMSEA = .073, SRMR = .068. The SR and Impulsivity did not correlate significantly, while the rest of the BAS scales from RST-PQ scales correlated positively with total score of the Mini-K. Thus, Reward Interest,

Goal-Drive Persistence, and Reward Reactivity reflect slow lifestyle.

In line with Jonason, Koenig, and Tost's (2010) suggestion that the general score of Mini-K should be interpreted with caution due to very broad nature of the construct, the CFA revealed that the Mini-K represents the hierarchically organized composite of adaptive strategies. This enabled the analysis on lower and general level. We conducted set correlation analysis (SCA) to examine the relationship of the BAS scales and Mini-K subscales (see Table 2). The SCA is a specific form of regression analysis that is able to control intercorrelations among the predictors and among the set of intercorrelated criterion variables (Cohen, Cohen, West, & Aiken, 2003). The two sets of variables were highly correlated (Cohen's set correlation $R^2 = .59$). Insight, planning, and control and Friends social contact and support subscales contribute the most to correlation with Reward Interest, Goal-Drive Persistence, and Reward Reactivity. The SR showed the most distinct pattern. It is negatively correlated with Experience in close relationships, decreases by aging, and it is higher in men. The results of the SCA among male and female participants did not differ (full information provided in ESM 1).

Table 1. Descriptive statistics and correlational matrix of the BAS scales and the Mini-K

	<i>M</i>	<i>SD</i>	α	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Mini-K – total score	5.34	0.98	.85	.68**	.59**	.67**	.72**	.71**	.47**	.32**	.44**	.39**	.14**	-.13**
2. Insight, planning, and control	5.13	1.10	.74	–	.24**	.36**	.28**	.42**	.18**	.44**	.57**	.38**	.13**	.04
3. Mother/father relationship quality	5.05	1.71	.69		–	.33**	.42**	.35**	.15**	.10*	.15**	.22**	.10*	-.04
4. Experience in close relationships	5.46	1.39	.60			–	.33**	.37**	.20**	.08	.27**	.24**	.06	-.18**
5. Family contacts and support	4.47	1.73	.89				–	.46**	.31**	.16**	.20**	.22**	.09	-.14**
6. Friends social contact and support	5.72	1.38	.92					–	.24**	.30**	.29**	.37**	.16**	-.09
7. Engagement in community	2.74	1.54	.56						–	.19**	.18**	.10*	.11*	.03
8. Reward interest	2.84	0.60	.82							–	.55**	.47**	.34**	.22**
9. Goal-drive persistence	2.92	0.61	.84								–	.49**	.21**	.21**
10. Reward reactivity	2.87	0.53	.82									–	.50**	.35**
11. Impulsivity	2.50	0.52	.69										–	.26**
12. Sensitivity to reward	0.22	0.12	.68											–

Note. *M* and *SD* show means and standard deviations of scale items summed and then divided by the number of items. * $p < .05$; ** $p < .01$ (all two-tailed).

Table 2. Set correlation analysis showing partial correlations between the BAS scales and the Mini-K subscales

	Reward interest	Goal-drive persistence	Reward reactivity	Impulsivity	Sensitivity to reward
Gender	-.03	.05	.04	-.05	-.16*
Age	.01	-.09	-.11	-.09	-.27**
Insight, planning, and control	.41**	.53**	.27**	.08	.15
Mother/father relationship quality	-.03	-.03	.05	.03	.00
Experience in close relationships	-.13	.05	.03	-.02	-.16*
Family social contact and support	-.01	.01	.01	-.01	-.11
Friends social contact and support	.17*	.02	.20**	.11	-.08
Engagement in community	.11	.08	.00	.08	.11
<i>R</i>	.49	.59	.47	.22	.39
<i>R</i> ²	.24	.34	.22	.05	.15
<i>F</i> (8, 448)	17.72**	29.34**	15.48**	2.78	9.90**

Note. * $p < .05$; ** $p < .01$ (all two-tailed).

Discussion

The main aim of the study was to examine relationships between the behavioral approach system (BAS) and life history theory (LHT). Generally, Reward Interest, Goal-Drive Persistence, and Reward Reactivity related to the slow, while the SR related to the fast lifestyle. Set correlation analysis (SCA) with the BAS scales and lower level of Mini-K factors showed: (a) *Insight, planning, and control* correlated with Reward Interest, Goal-Drive Persistence, and Reward Reactivity; (b) *Friend social contact and support* with Reward Interest and Reward Reactivity; and (c) *Experience in close relationship* correlated negatively with the SR.

In the following discussion, the framework to interpret the BAS components within LHT will follow Penke, Denissen, and Miller's (2007) approach to the study of

levels of personality throughout evolutionary theory. Here both the BAS scales and Mini-K scales reflect constructs that operate on the endophenotypic level, which assumes that the scores of the scales reflect psychological mechanisms that shape the personality traits on dispositional level.

Insight, Planning, and Control

Insight, planning, and control were highly correlated with Reward Interest, Goal-Drive Persistence, and Reward Reactivity. According to Figueredo, Cuthbertson, Kauffman, Weil, and Gladden (2012), higher levels of executive functions are prerequisite in development of the slow lifestyle strategy, and vice versa for fast lifestyle (Wenner, Bianchi, Figueredo, Rushton, & Jacobs, 2013). They argue that the

ability to inhibit the impulse for immediate gratification (e.g., self-control) is crucial to strive toward more long-term goals. This is the core feature of Goal-Drive Persistence, while planning is one of the core features of Reward Interest, which represents incentive motivation or initiativeness. Hence, it is not surprising that these two BAS scales were the most predicted BAS scales.

Reward Reactivity is also related with executive function reflecting slow lifestyle. This was not expected, since the Reward Reactivity reflects mainly the emotional BAS component, for example, the *liking* component of the BAS (Krupić & Corr, 2017; Krupić, Corr, et al., 2016). To explain this relationship, we examined the correlations between Mini-K items and scores of the BAS scales. Reward Reactivity scale correlated mostly with items reflecting insightfulness. Earlier studies related Reward Responsiveness from the BIS/BAS scales (Carver & White, 1994) with problem-solving coping strategies (Hasking, 2007), suggesting the potential role of Reward Responsiveness in goal-directed behavior beyond the rest of the BAS scales that might underlie this association.

In a recent study (Krupić, Gračanin, et al., 2016), the SR and Impulsivity were found to correlate with motives reflecting competitiveness (e.g., showing intellectual superiority, bragging with possessions, etc.), which corresponds to fast lifestyle strategy. However, our data did not reveal that. It should be expected that the SR and Impulsivity reflect lack of impulse control producing deficits in executive functions. However, analyzing the correlational matrix between the BAS scales and Mini-K items, the SR and Impulsivity were found to correlate negatively only with item “*I avoid taking risks.*” This is the only item that examines the risk-taking tendencies in the Mini-K, and in Croatian translation of the questionnaire, it did not fit the model. Thus, the lack of negative correlations between the SR and Impulsivity might reflect the underrepresentation of items measuring risk-taking and immediate gratification tendencies in the Mini-K.

Friend Social Contact and Support and Experience in Close Relationship

Fast lifestyle individuals engage in antagonistic rather than mutualistic social strategies (Figueredo & Jacobs, 2010), which was found to be important in defining relationship satisfaction in a long run (Olderbak & Figueredo, 2010). This study shows that social contact and support (as one aspect of the slow lifestyle) correlates with Reward Interest and Reward Reactivity, which is broadly consistent with findings of Krupić, Gračanin, et al. (2016). These relationships can be explained twofold. First, Reward Interest reflects proactivity and initiative, while complex

goals and projects may assume many social contacts and cooperativeness. As such, sociability is necessary for caring the projects that individuals high on Reward Interest found attractive. In addition, Reward Reactivity manifests in expressing positive reaction following reward, which influences individual's social status and social acceptance (Bono & Ilies, 2006; Lindsey, 2016). Alternatively, these findings support recent suggestions relating Reward Interest and Reward Reactivity to workings of dopamine and endogen opioids, respectively (see Krupić & Corr, 2017), that are found to play an important role in social behavior. In the same paper, Krupić and Corr (2017) related the SR and Impulsivity to the workings of testosterone, which is in addition related to interpersonal component of psychopathy (Yildirim & Derksen, 2012), which could explain negative relationship between the SR correlates and experience in romantic relationship.

Limitations

These findings should be interpreted with caution since they are obtained with a self-report methodology. Moreover, Mini-K is composed of manifest indicators that do not cover all the cognitions and emotions that might be an expression of LH strategy (Olderbak et al., 2014), and is related mostly to extraversion, agreeableness, and conscientiousness (Manson, 2015). In addition, some personality dimensions (such as extraversion and openness) are ambiguous from the standpoint of LHT (Del Giudice, 2014b). In further studies, results should be related with other LH psychological or behavioral indicators (e.g., self-control or sensation seeking). Also, as there are different instruments of the BAS scales and LHT, the findings from the study should be generalized only to studies that used the same questionnaires. Finally, it would be desirable to replicate the findings by different methodologies (list of potential experimental designs to complement this methodology can be found in Manson, 2015).

To conclude, our data indicate that Goal-Drive Persistence, Reward Interest, and Reward Reactivity reflect the BAS components that are a prerequisite to plan and achieve long-term goals that characterize slow lifestyle. In particular, the executive functions related to slow lifestyle are the most related to the BAS scales, which may direct future studies further exploring evolutionary origin of multi-dimensional approach motivation and its relationship with executive functions.

Electronic Supplementary Material

The electronic supplementary material is available with the online version of the article at <https://doi.org/10.1027/1614-0001/a000256>

ESM 1. Tables and Figure (doc)

Tables with set correlation analysis between the BAS scales and the Mini-K subscales separated for male and female participants; and CFA of Croatian Mini-K translation.

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