Relations between the behavioural approach system (BAS) and self-reported life history traits

Dino Krupić, University of J.J. Strossmayer in Osijek, Croatia,

Benjamin Banai,

Philip J. Corr, City University London, London, UK.

Dino Krupić, Department of psychology, Faculty of Philosophy, University of J.J.

Strossmayer in Osijek, Osijek, Croatia. Email: dkrupic@ffos.hr (Corresponding author).

Benjamin Banai,

Philip J. Corr, Department of psychology, City University London, London, UK.

Correspondence concerning this article should be addressed to Dino Krupić, Department of

psychology, University of J.J. Strossmayer in Osijek, L. Jaegera 9, 31000 Osijek, Croatia.

Email: dkrupic@ffos.hr.

Abstract

The importance of the behavioural approach system (BAS) in everyday life has been widely studied. However, there is a lack of empirical studies of its obvious evolutionary origin. The purpose of this study is to explore the multidimensionality of BAS processes within life history theory. Using the RST-PQ, we predicted that Goal-Drive Persistence and Reward Reactivity would serve to achieve important goals within a slow lifestyle, while Impulsivity and Sensitivity to Reward would represent a fast lifestyle. Four hundred and fifty-seven (173 males) respondents completed the RST-PQ and SPSRQ-20 to measure personality and they also completed the Mini-K to assess their lifestyle. Relationships were examined by structural equation model and set correlation analysis. The structural model showed that Reward Interest, Goal-Drive Persistence and Reward Reactivity correlated with slow lifestyle, while Impulsivity and Sensitivity to Reward did not correlate with the Mini-K, although the SR correlated negatively only with the Mini-K subscale Experience in romantic relationship. Set correlation analysis highlighted the importance of Insight, planning, and control, reflecting a slow lifestyle, in explaining the BAS within life history theory. The findings support the assumption of the evolutionary origin of the BAS and its components.

1. Introduction

Motivation psychology is concerned with two main questions: the *what* and *how* of the direction and strength of behaviour (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 important question that has been less studied: *Why*. 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. It is hypothesized that there are several unique motives that had an importance in resolving adaptive problems related to survival and reproduction of our ancestors (Bernard, Mills, Swenson, & Walsh, 2005).

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 for problems concerning 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 origin of resource acquisition strategies that enable adjustment to environmental conditions and, therefore, enhance the chance for gaining resources important for survival and reproductive success. We try to link the *how* with *what* aspect of motivation, and to provide the *why* of these links.

1.1 Approach motivation

Among others, appetitive or approach motivation is assumed to reflect the resource acquisition mechanism (Kenrick & Shiota, 2008). One of the most studied

approach/avoidance motivation traits is the behavioural approach system (BAS) within reinforcement sensitivity theory (RST; Corr 2008). This neuropsychological personality theory proposes the existence of three brain-behavioural circuits which represent general emotional-motivational systems: BAS representing approach, and behavioural inhibition system (BIS) and fight-flight-freezing system (FFFS) representing avoidance systems (Corr, 2008; Gray & McNaughton, 2000). This study focuses only on a part of the theory concerning the BAS.

The BAS is defined as brain-behavioural system that mediates reaction to cues of reward and non-punishment, and its primary function is to move an organism up the temporo-spatial 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) towards the final biological reinforcer (e.g., consumption of food) into four intertwined process: (a) identification of the biological important resource; (b) planning how to attain the resource; (c) execution of the plan (consummation); and lastly, (d) activation of 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 play an important role in obtaining resources. In recent developments of RST instruments, these processes are operationalised as: Reward Interest, reflecting identification of the biological reinforcer; Goal-Drive Persistence, encompassing planning behaviour; 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 main purpose of the 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 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 present two qualitatively different aspects of the same system. The former is described as impulsive part of extraversion, concerned by establishing the social dominance, surgency and aggression, while the later presents mechanism of establishing supportive social network through maintaining good relationships in 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, & 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 studies, a recent study (Krupić, Gračanin, & Corr, 2016b) showed the different roles of the 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 has not been exclusively related to one particular strategy. It correlated with exploring the environment, participating in competitions that signal gender-appropriate physical ascendancy, caring for relatives, and with reciprocation among non-kin. 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, growing body of evidences suggest that the BAS has two broad functions: one primarily concerned with resources and the second oriented toward social environment. In this study we examine how the BAS functions can be interpreted within life history theory (LHT).

1.2. 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 a fundamental trade-offs are made between current and future reproduction, between quality and quantity of offspring, and between mating and parenting effort (Del Giudice, 2014).

The LHT 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, low fertility, long lifespan, and high investment in offspring, while "fast" species are characterized by early maturation and reproduction, fast growth, small body size, high fertility, short lifespan, and low investment in offspring quality (Figueredo et al., 2005). As a species, humans fall at the "slower" end of continuum (Kuzawa & Bragg, 2012).

The same continuum may be used to differentiate individuals within a specie. The "fast" individuals are perceived as more exploitative/antisocial, bold, active, aggressive, less sociable, impulsive, prone to risk-taking, and dominant (Del Giudice, 2014; Sih & Del Giudice, 2012; Wolf, van Doorn, Leimar, & Weissing, 2007; Réale et al., 2010), while the individuals at the "slow" end of continuum perceive themselves more agreeable, conscientious, and honest (Del Guidice 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 favours individuals that most efficiently allocate limited resources in their distal genetic interests of reproduction and survival (Kaplan & Gangestad, 2005). Therefore, adaptiveness of the two lifestyles highly depends on environmental conditions (such as predation or diseases) (Quinlan, 2007; Ellis, Figueredo, Brumbach, & Schomler, 2009). For instance, in harsh environmental conditions it is more adaptive to start mating early and have low parental investment, to maximize reproductive success. 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 (Belsky, Steinberg, & Draper, 1991; Ellis, 2004). Individuals that have grown under more 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 behaviours.

The aim of the present study is to establish the relationship between fast 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 et al. (2016b) we expect that Impulsivity should reflect "fast" lifestyle, while Reward Reactivity and Goal-Drive Persistence should reflect "slow" lifestyle. In another words, we expect 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 compare the results, the same RST questionnaires from Krupić et al. (2016b) study exploring evolutionary role of the BAS will be used.

2. Methods

2.1. 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. Ethical committee of Faculty of Humanities and Social Science in Osijek gave the approval for this study.

2.2. Measures

The RST-PQ (Corr & Cooper, 2016) contains four the BAS scales: seven-items Reward Interest (e.g., "*I regularly try new activities just to see if I enjoy them*"); seven-items Goal-Drive Persistence (e.g., "*I put in a big effort to accomplish important goals in my life*"); ten-items Reward Reactivity (e.g., "*Good news makes me feel over-joyed*"), and; eight-items Impulsivity (e.g., "*I think I should 'stop and think' more instead of jumping into things too quickly*"). All items are answered on a four-point Likert scale. The Sensitivity to Reward (SR; e.g. "*Would you like to be a socially powerful person?*") from Sensitivity to punishment Sensitivity to Reward Questionnaires - 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 behavioural and cognitive aspects of life history strategies (Figueredo et al., 2006), based on more comprehensive Arizona Life History Battery (ALHB; Figueredo, 2007). Participants responded on a 7-point Likert scale. Higher scores reflect slower lifestyle. The Mini-K has been shown to be a valid and easy-to-administer measure of general life history strategy (Figueredo, et al., 2014).

Since this was the first application of Croatian translation of the Mini-K, we examined its construct validity. A one-dimensional model did not achieve the minimal goodness of fit indices according to Hu and Bentler (1999); χ^2/df between 2 and 5, CFI above .95, and RMSEA and SRMR below .08. However, the hierarchical model presented on the left side of the Figure 1. achieved acceptable model fit indices: χ^2 (113) = 367.90, χ^2/df=2.85, CFI = .927, RMSEA = .064, SRMR = .061. Error covariances were not added in the model. Thus, the results from the Mini-K can be used as a general score, which represents the composite variable of a set of subscales, and enables the analysis on general and specific domain level. The subscales are labelled according to ALHB (Figueredo, 2007): Insight, planning, and control (e.g. *"I often find the bright side to a bad situation."*), Mother/father relationship quality (e.g. *"While growing up, I had a close and warm relationship with my biological mother."*), Experience in close relationships (e.g. *"I have a close and warm romantic relationship with my sexual partner."*); Family social contact and support (e.*g. "I am often in social contact with my blood relatives."*), Friends social contact and support (e.g. *"I often get emotional support and practical help from my friends."*), and Engagement in community (e.g. *"I am closely connected and involved in my community."*). We excluded one item examining the participants' relationship with their own children, since the majority of our sample were not parents, and item "*I avoid taking risks*", since it does not fit the model.

Results

Descriptive statistics, reliability coefficients and correlations between LHT and BAS variables are presented in Table 1. Cronbach alpha 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 are examined by structural model presented in Figure 1. The examined model

achieved acceptable goodness of fit indices; χ^2 (213) = 531.12, χ^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.

- Figure 1 –

Further, we conducted set correlation analysis (SCA) to examine the relationship of the BAS scales and Mini-K subscales. The SCA is 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 show the most distinct pattern. It is negatively correlated with Experience in close relationships, decreases by ageing and it is higher in men.

- Table 1 -

- Table 2 -

4. Discussion

The main aim of the study was to examine the relationship between the behavioural approach system (BAS) and life-history theory (LHT). Reward Interest, Goal-Drive Persistence and Reward Reactivity were found to be related to the slow, while the SR related to the fast lifestyle. In line with Jonason, Koenig and Tost's (2010) suggestion that the general

score of Mini-K should be interpreted with cautious 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. 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.

4.1. Insight, planning and control

The highest correlations were found between Insight, planning and control and 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 impulse to consume immediate gratification (e.g. self-control) is crucial to strive towards 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 reflect mainly the emotional BAS component, e.g. the *liking* component of the BAS (Krupić, Corr, Ručević, Križanić, & Gračanin, 2016a). 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 behaviour beyond the rest of the BAS scales.

In recent study, the SR and Impulsivity were found to correlate with competitiveness (Krupić et al., 2016b), which corresponds to lifestyle strategy. However, our data did not reveal that. It would be expected that the SR and Impulsivity reflect lack of impulse control producing deficits in executive functions. However, analysing 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 adaptation on Croatian it did not fit the model. Thus, the lack of negative correlations between the SR and Impulsivity might reflect the under-representation of items measuring risk-taking and immediate gratification tendencies in the Mini-K.

4.2. Friend social contact and support and experience in close relationship

Fast lifestyle individuals engage in antagonistic rather than mutualistic social strategies (Figueredo & Jacobs, 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 et al. (2016b). First, Reward Interest reflects proactivity and initiativeness, while complex goals and projects may assume many social contacts and cooperativeness. In addition, Reward Reactivity manifests in expressing positive reaction following reward, which influence individual's social status and social acceptance (Bono & Ilies, 2006; Chen, Hsu, and Tsai, 2013; Lindsey, 2016).

Maintaining close relationships demand high level of self-regulation, as it assumes occasionally self-sacrificing and putting others needs in the first place. In contrast, impulsive

individuals, particularly psychopaths, may find hard to maintain friendships (Glenn, Kurzban, & Raine, 2011). Fast individuals typically minimize parental investment, and they are more interested in short-term relationships. Our data shows that the SR correlates negatively with experience in romantic relationship, which is congruent with the previous study exploring the evolutionary origin of the BAS (Krupić et al., 2016b).

*Limitation*s

As already mentioned, the Mini-K is a short measure of very broad construct. Figueredo et al. (2014) 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. Although the Mini-K has been found to represent a valid approximation of the lifestyle, we are quite assured that the results, and thereby conclusions, would differ if the full 199-items version of ALHB was used instead. This particularly stands for the SR and Impulsivity.

To conclude, our data suggest that Goal-Drive Persistence, Reward Interest and Reward Reactivity reflect the BAS components that are prerequisite to plan and achieve long-term goals that characterise slow lifestyle. In particular, the executive functions related to slow lifestyle are the most related with the BAS scales, suggesting that the BAS scales may explain the *how* mechanism of the LHT.

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Table 1.

*Descriptive statistics and correlational matrix of the BAS scales and the Mini-K*

		M	SD	α	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1.	Mini-K – total score	96.18	17.70	.85	.68**	.59**	.67**	.72**	.71**	.47**	.32**	.44**	.39**	.14**	-.13**
2.	Insight, planning and control	25.65	5.49	.74	-	.24**	.36**	.28**	.42**	.18**	.44**	.57**	.38**	.13**	.04
3.	Mother/father relationship quality	10.10	3.41	.69		-	.33**	.42**	.35**	.15**	.10*	.15**	.22**	.10*	-.04
4.	Experience in close relationships	16.37	4.18	.60			-	.33**	.37**	.20**	.08	.27**	.24**	.06	-.18**
5.	Family contacts and support	13.42	5.19	.89				-	.46**	.31**	.16**	.20**	.22**	.09	-.14**
6.	Friends social contact and support	17.16	4.14	.92					-	.24**	.30**	.29**	.37**	.16**	-.09
7.	Engagement in community	5.48	3.08	.56						-	.19**	.18**	.10*	.11*	.03
8.	Reward Interest	19.88	4.21	.82							-	.55**	.47**	.34**	.22**
9.	Goal-Drive Persistence	20.42	4.28	.84								-	.49**	.21**	.21**
10.	Reward Reactivity	28.65	5.34	.82									-	.50**	.35**
11.	Impulsivity	20.03	4.16	.69										-	.26**
12.	Sensitivity to Reward	4.37	2.36	.68											-

*- p<0.05; **- p< 0.01

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	SR
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
R	.49	.59	.47	.22	.39
R2	.24	.34	.22	.05	.15
F(8,448)	17.72[**]	29.34[**]	15.48[**]	2.78	9.90[**]
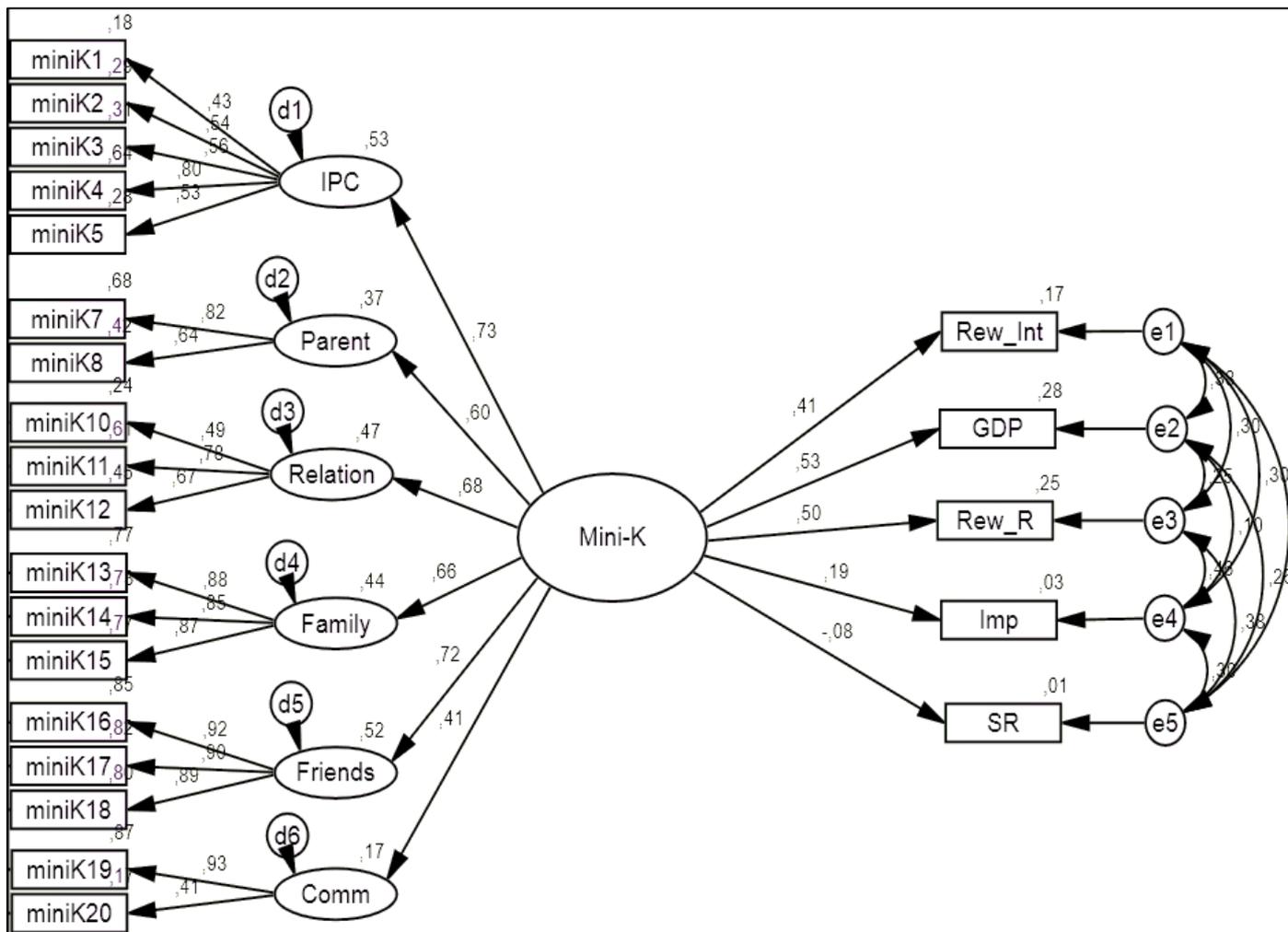
Figure 1. Relationship between general score of the Mini-K and the BAS scales

Note: 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.

Table 1. Set correlation analysis showing partial correlations between the BAS scales and the Mini-K subscales (male participants)

	Reward Interest	Goal-Drive Persistence	Reward Reactivity	Impulsivity	SR
Age	-.12	-.12	-.21[*]	-.04	-.27[**]
Insight, planning, and control	.44[**]	.53[**]	.31[**]	.18[*]	.18[*]
Mother/father relationship quality	-.09	-.02	.04	.01	-.06
Experience in close relationships	-.12	-.01	.00	-.02	-.21[*]
Family social contact and support	-.02	-.05	-.09	-.01	-.20[*]
Friends social contact and support	.20[*]	.03	.19[*]	.08	.02
Engagement in community	.10	.13	.05	.05	.13[**]
R	.55	.59	.48	.23	.44
R^2	.31	.35	.23	.06	.19
F(7, 165)	1.38[*]	12.77[*]	7.03[*]	1.36[**]	5.65[*]

Cohen set correlation R^2= .58, F(35, 650.25) = 4.22

[*]p<.01, [**]p<.05

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

	Reward Interest	Goal-Drive Persistence	Reward Reactivity	Impulsivity	SR
Age	.09	-.06	-.01	-.12[*]	-.28[*]
Insight, planning, and control	.37[**]	.51[**]	.19[*]	.03	.13[*]
Mother/father relationship quality	.01	-.04	.05	.05	.02
Experience in close relationships	-.10	.09	.09	-.03	-.11[*]
Family social contact and support	-.02	.05	.08	-.01	-.03
Friends social contact and support	.18[**]	.01	.23[**]	.13	-.15[*]
Engagement in community	.11	.04	-.04	.08	.08
R	.47	.58	.47	.23	.29
R^2	.22	.33	.22	.05	.09
$F_{(7, 276)}$	11.26[*]	19.79[*]	11.21[*]	2.15[**]	3.68[*]

Cohen set correlation R^2= .56, $F_{(35, 1117.18)}$ = 6.97
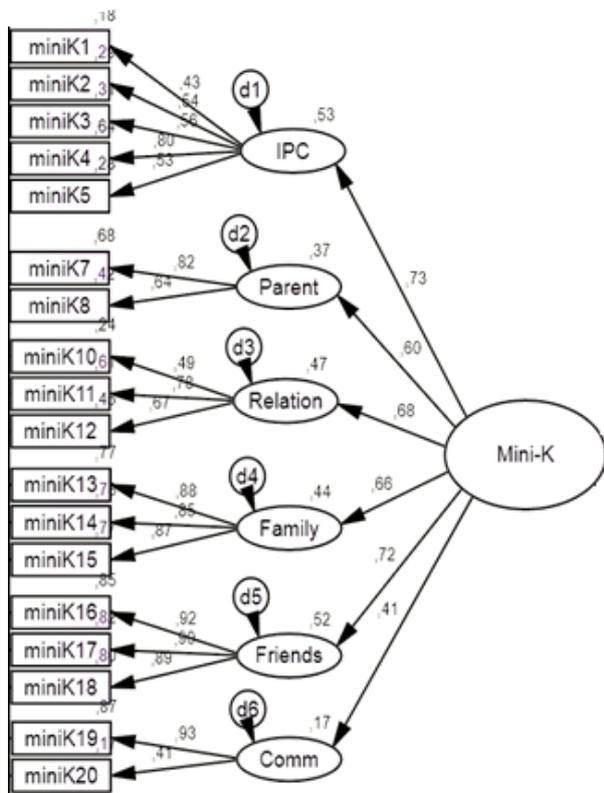
[*]- $p<.01$; [**]- $p<.05$

Figure 1. Since this was the first application of Croatian translation of the Mini-K, we examined its construct validity. A one-dimensional model did not achieve the minimal goodness of fit indices according to Hu and Bentler (1999); χ^2/df between 2 and 5, CFI above .95, and RMSEA and SRMR below .08. However, the hierarchical model presented on the left side of the Figure 1 achieved acceptable model fit indices: χ^2 (113) = 367.90, χ^2/df=2.85, CFI = .927, RMSEA = .064, SRMR = .061. Error covariances were not added in the model. Thus, the results from the Mini-K can be used as a general score, which represents the composite variable of a set of subscales, and enables the analysis on general and specific domain level. The subscales are labelled according to ALHB (Figueredo, 2007): Insight, planning, and control (e.g. *"I often find the bright side to a bad situation."*), Mother/father relationship quality (e.g. *"While growing up, I had a close and warm relationship with my biological*

mother."), Experience in close relationships (e.g. *"I have a close and warm romantic relationship with my sexual partner."*); Family social contact and support (e.*g. "I am often in social contact with my blood relatives."*), Friends social contact and support (e.g. *"I often get emotional support and practical help from my friends."*), and Engagement in community (e.g. *"I am closely connected and involved in my community."*). We excluded one item examining the participants' relationship with their own children, since the majority of our sample were not parents, and item "*I avoid taking risks*", since it does not fit the model.