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THE METACOGNITIVE SELF: THE ROLE OF MOTIVATION AND AN UPDATED MEASUREMENT TOOL

Hanna Brycz,
University of Gdansk, Gdańsk, Poland,
E-mail: psyhb@ug.edu.pl

Roman Konarski,
University of Gdańsk, Poland
E-mail: psyrk@ug.edu.pl

Paweł Kleka,
Adam Mickiewicz University of Poznań, Poland
E-mail: kleka@amu.edu.pl

Rex Wright,
University of North Texas, USA
E-mail: Rex.Wright@unt.edu

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ABSTRACT. The aim of this article is to present the theoretical motivational background regarding metacognitive self, which is being aware of how biases and psychological rules (like classic conditional) influence one's own behavior. Based on this framework, we used a Polish nationwide representative sample to create a reliable tool (the first study: *n = 1200*, the next study *n = 600,* Partner in Business Strategy Company as an external contractor, who served as data collector). Until now, the MCSQ-40 questionnaire has been used. After modification – changing the continuous scale into a 6-point scale – and a survey of a representative sample of the Poles, a single-factor structure of metacognitive self was developed, and 21 items out of 40 previously used were selected. This resulted in developing a new tool: MCSQ-21. We assessed the congruent and concurrent validity of this instrument.

Keywords: metacognition, biases, motivation, metacognitive self, tool to measure metacognitive self, MCSQ-21.

This article has two aims. One is to discuss the role of motivation in relation to the concept of metacognitive self. The second is to present an updated, short-form, instrument to measure metacognitive self – the Metacognitive Self Questionnaire-21 (MCSQ-21). The updated instrument is based on a more extended instrument developed previously, the Metacognitive Self Questionnaire-40 (MCSQ-40, Brycz & Karasiewicz, 2011). We describe the theoretical framework leading to the creation of the instruments as well as the factor structure of MCSQ-21, using the data from Polish nationwide sample.

Metacognition

The concept of "knowledge of one's own knowledge" – i.e., metacognition – was first developed in philosophy (for perspectives, see Sachs, 2001). It was introduced into psychological science by Wilhelm Wundt (1883, 1896) and has attracted increasing attention in ensuing years (Brinol & DeMarree, 2012; Efklides & Valachopoulos, 2012; Flavell, 1979; Koriat, 2007; Schwarz, 2015; Nelson & Narens, 1990; see also: Petty & Fabrigar, 2008). Metacognition is also important research area in sociology (e.g. via focus on recognition of the importance of the audience member, content of media message in understanding media effects: Becker, Kosicki, (1995), and political science (e.g. metapractises addresses political issues, Gunnel, 2009). Jost, Kruglanski and Nelson (1998) argued that metacognition occurs when people think about their own mental states or corresponding states in the minds of other people. Dunlosky and Metcalfe (2009) defined it as intrinsically motivated thinking about one's own thinking

Metacognition can help people create complex knowledge about how they and others function socially, cognitively, and emotionally (Kruglanski, 1989). Creation of such knowledge allows people to form lay theories of personality, mind, and attitudes that significantly influence their behavior (e.g., Dweck, 2000). Metacognition also can help create tasks motivation (Scholer & Miele, 2016). Without a doubt, the quality of "thinking about thinking" and its result (such as a given mind theory or trait theory) determine the whole spectrum of social behaviors, such as making friends with specific people, successful planning, completing actions, correcting biases (e.g. Wegener & Petty, 1995), or producing bias (Schwarz, 2015), etc.

Simultaneously with the development of the knowledge of human metacognition, tools to measure this phenomenon were created. Among these tools, researchers developed questionnaires of metacognitive awareness (e.g., the Metacognitive Awareness Inventory, MAI; Schraw & Dennison, 1994) and of meta-awareness of various areas of life, such as learning strategies (Pressley, 2000), and even of metacognition of one's own mathematical skills (Efklides & Valachopoulos, 2012). On the other hand, clinical psychologists focused on dysfunctional metacognition that fosters rumination. The Metacognitive Questionnaire, MCQ-30 was created (Carthwright-Hatton & Wells, 1997; Polish adaptation: Dragan & Dragan, 2011) to measure metacognitive beliefs and their relationship with lingering emotional dysfunctions. Wells and Matthews (1996) showed that dysfunctional beliefs are a basis upon which psychic disturbances form and continue to exist. Individuals who score higher in this questionnaire are more likely to suffer from nervousness, anxiety attacks, obsessive-compulsive symptoms, hallucinations, anorexia, and major mental disturbances (such as psychosis). Dysfunctional beliefs might affect economic and political decisions. Thus poor economic performance suffer from self- evaluation errors (Schlosser, Dunning, Johnson, & Kruger, 2013, Danaj, Lazanyi, & Bilan, 2018).

Adaptive metacognition cited in positive psychology not only assumes the absence of maladaptive features in human beings, but also the presence of adaptive dispositions fostering motivation (Beer & Moneta, 2010; Polish adaptation: Konarski & Brycz, 2017). Based on this brief description of our approach to metacognition, we wish to present the construct of metacognitive self (MCS).

Metacognitive Self

A new concept of MCS, accompanied by an instrument to measure the construct, is presented in this article. In general, MCS pertains to self-awareness of biases. In the introduction above, we mentioned the positive motivational roles of "adaptive"

metacognition. It appears that one of those is to have insight into one's own psychological rules or biases (such as the illusion of control; Langer, 1975).

This is the right place to provide a few examples of different biases, called now psychological rules of human mind. One of them is illusory correlation, which occurs when the presence of causal relationship is perceived where, in fact, merely a coincidence in time exists (Nisbett & Borgida, 1975). For example, seeing a dirty, sloppily dressed man in a station waiting room leads us to associate the place and clothes of a person with his other presumed features, such as being unemployed or homeless. The very same man, behaving the same way and also seen in the station waiting room, but dressed in clean and neat clothes, would promote entirely different associations – for example, that of a person on a business trip. Our bias is that we prematurely correlate several features: how a person looks and where he or she is located become a basis for classifying that person within a certain category. The "illusory correlation" is fundamental to how stereotypes or prejudices are formed (Chapman & Chapman, 1969). Another common tendency is "confirmatory bias" (Heider, 1958). It is a human need that those beliefs about the nature of things that occurred to us first tend to be confirmed. For example, a doctor who diagnosed on the basis of initial information would use test results to confirm the diagnosis, as long as some powerful results do not obviously contradict that diagnosis. Another example of confirmation bias is the following: the appearance of a newly met person arouses our reluctance and an initial negative opinion; in consequence, we look for negative information about that person to confirm our earlier assumptions. This latter example is what is also called "the devil effect" – it is manifested, among other things, in attributing negative personality features to unattractive people (Harvey & Smith, 1977). Moreover some biases are basis for aggression. Ultimate attribution error, for example, enlarges fundamental attribution bias on ingroup vs. outgroup ground. Ultimate attribution error let ingroup members think that negative acts of outgroup members are caused by their traits (regardless of situation). The kind of error allows for nationalism, discrimination, etc, as minority studies appeal (Kephart, 1950).

Since the 1970s, there has been a flood of reports on biases, errors, illusions, and fallacies, and the human mind has been called irrational (e.g. Nisbett & Ross, 1980). However, the development of our civilization and its scientific progress question this approach to human functioning. Do errors and illusions really hinder development? Can the metacognitive insight into one's irrationality be adaptive? Ruminating about being irrational is hardly adaptive, just as clinicians claim (Wells & Matthews, 1996). In terms of clinical psychology, we can also consider the fact that many biases are exploited by manipulators (sociopaths, psychopaths), who cruelly use the knowledge of human errors for their own ends and at the expense of others. For example, domineering individuals who enjoy using violence in a dyad, utilize the so-called commitment and consistency trap – to which the ill-treated partner succumbs by staying in a toxic relationship (Cialdini, 1994). Moreover Fleming (2013) warned against political extremes and extremist politics, all based on biases and errors. What is visible here is an asymmetry in one's ability to perceive biases in one's own vs. someone else's behavior. Quite common knowledge about the biases of others does not easily translate into recognizing the influence that various psychological rules have on one's own behavior (Brycz, 2011; Pronin, Lin, & Ross, 2002). In the example above, the manipulators in family or in politics are fully aware of his or her partner's submission and fear of leaving the relationship that they have invested so much in. These, however, are not perceived by the victim.

It should be noted, however, that psychological rules do not exist solely to be exploited by manipulators. Quite the opposite, most biases (e.g., the ones resulting from how heuristics operate) help us to function effectively (Nisbett & Ross, 1980). Since the paper by Kahneman and Tversky (1973), many disturbances in rational thinking and decision making

have been identified; these, however, were produced evolutionarily as a result of our adaptation to living in social groups. What is more, they serve their purpose to this day (e.g., the reciprocity principle, also called social glue; Cialdini, 1994). Taylor and Brown (1988) argue that manifestations of so-called deviations from rationality are one of the conditions of mental health. This view is challenged by Colvin and Block (1994). They suggest that excessive use of biases, such as a constant search for positive information about oneself (self-enhancement), is not conducive to good adaptation, although it is, indeed, important to use the feedback provided by our environment. Sociologists (Robb, 1978) underline difficulties and cons rather than pros flowing from biases. Inter - group relations are vulnerable provoking conflicts. However positivity bias fosters negotiations, and satisfactory solutions (Markowska - Przybyła, & Ramsey, 2015).

The construct of MCS is consistent with the idea of the evolutionarily developed motivationally adaptive role of biases, as proposed by Taylor and Brown (1988), while at the same time it accepts the limitations of this theory specified by Colvin and Block (1994). Therefore, it embraces the Aristotelian idea of the golden mean when it comes to the adaptive role of psychological rules. We claim that knowing about some of the deviations from rationality or some rules in one's behavior can – to a varying degree – encourage motivation and self-regulation. For example, although high-MCS individuals are more likely to have their behaviors influenced by psychological rules and biases than low-MCS individuals, this does not mean they are not capable of self-reflection. On the contrary, deep insight into one's self relies on a lasting capability to accurately evaluate one's actions. High-MCS individuals (as compared with low-MS individuals) more often motivated to use information which helps their self-knowledge and psychological self-repair, while their level of seeking self-enhancing information remains the same (Brycz, Wyszomirska-Góra, Bar-Tal & Wisniewski, 2014; Brycz, Wyszomirska-Góra, Konarski, & Wojciszke, 2018). Probably, high metacognitive self enhances one's abilities to monitor one's behavior according to internal and external motivational standards, fosters accurate self-evaluation, and also leads to automatization of knowledge about the self (which would otherwise not be readily available). This permits the use of beneficial effects of the biases, as well as avoiding unhealthy rumination and affective disorders with dominating depressive tendencies.

Therefore, knowledge about one's psychological biases and rules should belong to the adaptive and motivating kind of knowledge. In order to increase the likelihood that what we study is, indeed, adaptive metacognition, 129 biases (like: mistaken in logical thinking, illusory correlation, confirmation bias, Nisbet, & Ross, 1989; attribution biases, Weiner, 2018) together with psychological rules (like goal commitment, Belanger, Schumpe, Lafreniere, Giacomantonio, Brizi, & Kruglanski, 2016) were evaluated by competent judges and rated on five dimensions (Brycz, 2011). The attempt to establish what amount of knowledge about given biases would be more motivationally adaptive than knowledge of other biases or rules appeared crucial. To do that, competent judges evaluated each of the 129 biases to assess the extent to which knowledge about each bias fosters features anchored in intrinsic motivation that enhances life satisfaction (Hefer & Dreisbach, 2016; Luhmann & Hennecke, 2017):

1) self-regulation,
2) self-monitoring,
3) delaying gratification,
4) self-distance,
5) preserving moral standards.

The purpose of this procedure was to identify the tendencies which – once they live in an individual's consciousness as his or her own (a part of the strong self- digest, Higgins, Kruglanski, 2000) – help in features of intrinsic motivation like: self-regulation, self-control,

motivation (by delaying gratification), maintaining socially important standards and moral norms, and – which is crucial – in keeping a healthy self-distance. Our judges were psychologists holding a master's degree and fifth-year students of psychology at the University of Gdańsk. The judges demonstrated accuracy in all five dimensions and agreed in their opinions (Kendall's W was significant). The results for all five dimensions were positively and quite strongly interrelated, which allowed us to single out 40 regularities with the highest scores on all the above dimensions (Brycz & Karsiewicz, 2011). Knowledge of these 40 regularities in one's behavior constitutes metaknowledge of self – adaptive insight into psychological biases and rules, one that is held in both semantic and episodic memory. In other words, metacognitive self as self- awareness of biases is the accurate recognition of adaptive psychological biases and psychological rules guiding one's behavior.

Accordingly, MCS, as anchored in intrinsic motivation, should encourage self-regulation, perseverance, and self-efficacy. Previous studies (Brycz, 2011) show that high-MCS individuals (vs. low-MCS individuals) are highly intrinsic motivated to work under conditions of overload, have a high need for achievement, and are more pronounced in accepting values such as self-directedness and achieving. What is more, high-MCS individuals (as opposed to low-MCS individuals) are more aware of the fact that certain events in life are beyond anyone's control (Brycz, Jurek, Wojciechowska, Peplińska, & Bidzan, 2014). In addition, as mentioned above, high-MCS individuals, simultaneously believing in their low ability to achieve cognitive structuring (which implies piecemeal processing), indeed, display biases more often than low-MCS individuals (Bar-Tal, Brycz, Dolinska, & Dolinski, 2017). On the one hand, this result confirms the tool's validity (the higher MCS, the larger the biases); on the other hand, along with other results, it confirms that certain biases in our thinking and feeling may be motivationally adaptive (as postulated by Taylor & Brown, 1988).

The Metacognitive Self Questionnaire-40

Ever since the work on metacognitive self began, there has been a need for a tool to measure metacognitive self. Brycz and Karasiewicz (2011) proposed the first version of the metacognitive-self questionnaire, MCSQ-40. The questionnaire turned out to be valid and reliable, with high content validity, even though groups of test subjects (N = 1903) were recruited mainly from among students and young working adults. The questionnaire is composed of 40 items corresponding to the 40 previously isolated adaptive psychological rules or biases. Each of them was presented in an episodic form. Participants ranked each item, one by one, on a scale ranging from 0% (does not apply) to 100% (fully applies), to indicate to what extent a given regularity is manifested in their behaviors. It is true that these regularities (such as heuristics or the rules of social influence) are, in fact, statistical generalizations, but their common occurrence has been proved and replicated by many researchers. This is why we initially believed that the more our subjects saw the rules and biases in themselves, the greater were their insight into the self (metacognitive self). Further studies revealed that there is, in fact, a positive correlation between one's score on the MCSQ-40 scale and a tendency to demonstrate biases in one's behavior (Brycz et al., 2014). The index value of metacognitive self was either the mean or the sum resulting from the assessment of all 40 regularities, calculated individually for each participant.

Owing to insufficient methodological purity in the construction of MCSQ-40 (the tested sample was heterogeneous in terms of age, education, and origin), we decided to create a more reliable tool to measure the levels of metacognitive self in strict compliance with the strongest determinants of psychological research methodology.

The test sample is a representative sample of Poles. The MCSQ-40 questionnaire was unified regarding the episodic character of each presented rule or bias, and was stylistically improved. We also decided to use the Likert scale (as attached) instead of the continuous 0-100% scale; this was because the respondents were limiting themselves to discrete points when using the former scale anyway, and, from a human perspective, the latter scale is easier to grasp. These considerations prompted us to change the continuous scale (methodologically powerful) to the ordinal scale (slightly weaker, but more understandable for participants).

We expect the MCSQ-40 to have a hierarchical factor structure with one top level factor and four sublevels factors. This is based on a theoretical approach in which metacognitive self is understood as a homogeneous whole, a psychological construct of a motivationally adaptive nature. Why do we think MCSQ-40 is a monolith? This is because of the theoretical approach relevant to considering metacognition. We have already outlined the theories that treat metacognition as adaptive (Beer & Moneta, 2010) and maladaptive (Wells & Matthews, 1996). The authors postulated their models to hierarchical structure ending in a single-factor structures, even though they encompass different substantial areas. In the case of maladaptive metacognition, this can be a tendency to ruminate on the self, concentrating on the symptoms of one's disease, etc. On the other hand, adaptive metacognition involves high skills in acquiring self-related knowledge and monitoring one's behavior. The test also contains items that check whether a participant demonstrates motivation to learn about him- or herself. Metacognitive self is a kind of self-knowledge, more exactly, self-awareness of biases that foster self-regulation. It encompasses the social and cognitive functioning of a person in various areas of life. These areas include: the laws of memory (e.g., the knowledge of "intrusions" or "false alarms"), rules in decision-making (e.g., the knowledge of post-decision regret or seeking information confirming one's choice), the knowledge of social influence (the reciprocity principle, the commitment and consistency principle, liking, etc.), and the knowledge of many more rules, such as a shift in self-attribution over time or the pathetic fallacy. We assume that although adaptive self-knowledge comprises different areas, it determines better self-regulation only when integrated (not fragmented, for example concerning only one's memory). What is more, all five dimensions on which the judges rated our 129 psychological regularities (self-regulation, self-distance, self-monitoring, delaying gratification, moral norms) are theorized to form one joint motivational dimension of self-awareness of biases – one that is subjective and having important regulatory functions (Alicke, Dunning, & Krueger, 2005). On the other hand, as was mentioned above, biases, irrationalities, illusions, fallacies (nowadays commonly called psychological rules) belong to certain categories connected with various areas of human functioning, such as attribution errors, illusions in logical reasoning, mistakes in decision-making, principles of social influence, etc. Therefore, we expect that analysis will reveal sub-factors in hierarchical structure covering the identified areas.

The Metacognitive Self Questionnaire-21

Method

The construction of a short form of the Metacognitive Self Questionnaire-21 (MCSQ-21) and establishing its psychometric properties consisted of two phases, conducted with two independent samples of participants. The primary goal of phase one was shortening the long form (MCSQ-40) of the questionnaire and establishing the factor structure of the MCSQ-21. This part of the project was conducted in a calibration sample of n = 1,204 participants. Phase two consisted of cross-validating the factor structure of the MCSQ-21 established in phase

one and assessing its measurement reliability and validity. This part of the project was conducted in a validation sample of n = 600 participants.

Participants

All participants provided written informed consent to participate in the study in reference to the reviewed and approved decision by Ethics Committee for Research Projects, Institute of Psychology, University of Gdansk (no 17a/2013). A nationally representative sample of n = 1204 adult Poles between the ages of 18 and 88 participated in this part of the study. All participants provided written informed consent to participate in the study. Among the participants, 631 were female and 573 were male. Mean age of the female sample was M = 45.01 years (SD = 16.17) and the male sample was M = 46.74 years (SD = 16.21). The education structure of the sample matched that of the Polish population and comprised 20.4% participants with primary education, 24.5% with basic vocational education, 35.6% with high school education, and 19.7% with higher education.

Procedure

Participants were selected randomly from the personal identity number registry. Interviews were conducted individually at the places of residence of the participants. The study was commissioned to PBS Partner in Business Strategies service and paid by National Science Centre, grant 2013/11/B/HS6/01463. PBS delivered database. The participants were informed about the scientific aims of the research project and assured of their anonymity. There was no reward for participation in the study. Each participant completed the MCSQ-40 (described below). Completion of the questionnaire took approximately 10 minutes. At the conclusion of each interview, all participants were thanked and fully debriefed. The study was approved by the Polish Ethical Committee as compliant with ethical standards.

Measure

As described in the Introduction, the MCSQ-40 (Brycz & Karasiewicz, 2011) assesses a single metacognitive factor with 40 items covering six areas of individual functioning: memory biases (4 items), attribution biases (7 items), social cognitive laws (10 items), community-agency biases (4 items), social influence (8 items), and persuasion laws (7 items). Each item presents a bias or a psychological law in the form of episodic behavior. For each item, individuals are asked to respond to the question: "How much is each statement congruent with your behavior, thoughts, and/or feelings?" Responses follow a 6-point Likert-type scale ranging from 1 (Definitely not) to 6 (Definitely yes).

Results

Psychometric Analyses

The primary task of this part of the study was to confirm the factor structure of the MCSQ-40 and to construct a short form of the questionnaire referred to as MCSQ-21. The fit of the factor structure and the reliability of the MCSQ-40 are reported in the current study for comparison purposes with the fit of the factor structure and the reliability obtained for the MCSQ-21. The factor structure of the MCSQ-40 and the MCSQ-21 was evaluated by confirmatory factor analysis for discrete indicators using Mplus 7.4 (Muthen & Muthen,

1998, 2012). The CFA models were tested using the robust weighted least squares estimator (Satorra & Bentler, 1994). Since the value of the χ^2_{SB} model-fit test statistic is inflated by a large sample size, model fit was also assessed using two widely-used indices: the root mean square error of approximation (RMSEA) and the comparative fit index (CFI).

The reliability of the long (MCSQ-40) and short (MCSQ-21) forms of the Metacognitive Self Questionnaire was assessed by means of model-based reliability estimation (Brunner & Sub, 2005; Miller, 1995; Raykov, 1997) from an appropriate CFA model estimated for each form of the instrument. It is widely known that traditional internal consistency reliability indices, such as Cronbach's alpha, underestimate reliability when items are not essentially tau-equivalent (when they have unequal factor loadings) (Graham, 2006), or when the item response scale is not continuous (Gadermann, Guhn, & Zumbo, 2012). As the assumption of tau-equivalence is unlikely to hold for our measures and the item response scales are ordinal, we utilized model-based reliability estimates based on CFA for ordinal variables utilizing polychoric correlations.

The Factor Structure and Reliability of the MCSQ-40

As the MCSQ-40 assesses a single metacognitive dimension in six areas of individual functioning, a bi-factor model (Reise, 2012) with a single general factor and six group factors was tested. In the tested bi-factor model, the general factor represents the general metacognitive self, whereas the six uncorrelated group factors represent the six areas of social and cognitive functioning uncorrelated with the general factor. For the purpose of model fit comparison, the fit of a six correlated-factors model and a single-factor model was also examined. The two models constitute rival and successively more restricted specifications of the factor structure for the MCSQ-40. In the six-factor model, the six areas of social and cognitive functioning are represented by six correlated factors and the general metacognitive self dimension is excluded from the model. In the single-factor model, on the other hand, the general metacognitive self is represented by a single factor and the six dimensions of individual functioning are not represented in the model.

Yung, Thissen and McLead (1999) and Reise (2012) have demonstrated that the three tested models constitute a nested hierarchy of alternative CFA representations, with the bi-factor model being the most general, and the single-factor being the most restricted. As a consequence, the procedure for scaled difference testing outlined by Bryant and Satorra (2012) was followed to compare the fit of the bi-factor model to each of the more restricted rival model specifications.

The results of testing the alternative factor models for the *MCSQ-40* are summarized in Table 1. As can be seen in Table 1, the fit of the bi-factor model is moderately satisfactory with robust RMSEA = .079, that is just below the threshold of model rejection level at .10, and robust CFI = .75, that is below model acceptance level of .90. Assuming, however, that the bi-factor structure is acceptable for the *MSCQ-40*, it is possible to examine whether rival representations in the form of a six correlated-factors model or a single-factor model are more appropriate. As can be seen in Table 2, restricting the bi-factor model to six correlated group factors (areas of individual functioning) significantly reduces model ($\Delta\chi^2_{SB}$ = 714.12, Δdf = 25, $p < .001$) as well as restricting to a single general factor (general metacognitive self) model ($\Delta\chi^2_{SB}$ = 1154.50, Δdf = 40, $p < .001$). This furnishes further support for the bi-factor representation of the factor structure of the MCSQ-40.

Table 1. Summary of model fit statistics for the bi-factor, the six-factor and the single-factor models for the MCSQ-40

Model	χ^2_{SB}	*df*	$\Delta\chi^2_{SB}$	Δdf	RMSEA	CFI
Bi-factor	5930.37***	700	---	---	.079	.74
Six-factor	6735.86***	725	714.12***	25	.083	.72
Single-factor	7182.80***	740	1154.50***	40	.085	.70

Note. $N = 1204$; $^{***}p < .001$

Model based reliability coefficient omegaH (McDonald, 1999; Zinbard, Revelle, Yovel, & Li, 2005) for the MSCQ-40 general factor is .80. The reliability estimate may serve as a benchmark for judging the degree of reduction in measurement reliability of the short form of the scale that consists of a reduced number of items.

A Short Form of the MCSQ-21

A short form of the MCSQ-40 was created by discarding items with lowest factor loadings on the primary metacognitive factor and highest loadings on their corresponding group (area of functioning) factor, with the restriction that five substantive areas ("memory biases", "attribution biases", "social cognitive laws", "community-agency biases", and "persuasion laws") were represented by three items each, and one ("social influence") by six items. This resulted in a short form of the scale, referred to as the MSCQ-21, composed of 21 items.

Factor structure and reliability of the MCSQ-21

The factor structure of the MCSQ-21 was evaluated in a sequence of confirmatory factor analyses summarized in Table 2. The sequence of tested models commenced with a 6-factor model, representing the six correlated substantive group factors (areas of individual functioning). However, the factor solution for this model was not proper as the factor correlation matrix was not positive definite. This was caused by correlations above one between "factor 2" (attribution biases) and "factor 3" (community-agency biases), and between "factor 4" (social cognition laws) and "factor 5" (persuasion laws). As a consequence the initial six areas of individual functioning were reduced to four more general areas in which "attribution biases" and "community-agency biases" were combined into "perceptive biases" (6 items), and "social cognition laws" and "persuasion laws" were combined into "social learning laws" (6 items). The two remaining areas were "memory biases" (3 items) and "social influence" (6 items).

Table 2. Summary of model fit statistics for alternative models for the MCSQ-21 in the calibration sample

Model	χ^2_{SB}	*df*	$\Delta\chi^2_{SB}$	Δdf	RMSEA	CFI
Six correlated factors	911.81***	174	---	---	.059	.92
Bi-factor with four group factors	741.87***	168	---	---	.053	.94
Four correlated factors	939.64***	183	188.83***	15	.059	.91
Single-factor	1077.77***	189	318.01***	21	.062	.90

Note. N = 1204. ***- $p < .001$

As can be seen in row two of Table 2, the fit of the bi-factor model with four group (areas of individual functioning) factors and a single general (metacognitive self) factor is very good (robust RMSEA = .053, robust CFI = .94). Moreover, the two rival models in the form of the four correlated-factors model and the single-factor model represent a significant reduction of model-data fit in comparison to the bi-factor model. That is, although the fit of the four correlated-factors model is acceptable (robust RMSEA = .059; robust CFI = .914), it represents a significant reduction of fit in comparison to the bi-factor model ($\Delta\chi^2_{SB}$ = 188.83, Δdf = 15, p < .001). Likewise, although the fit of the single-factor model is generally acceptable (robust RMSEA = .062, robust CFI = .90), it represents a significant reduction in model fit in comparison to the bi-factor model ($\Delta\chi^2_{SB}$ = 318.01, Δdf = 21, p < .001). Hence the bi-factor model with four uncorrelated group (areas of individual functioning) factors and a single general (metacognitive self) factor was accepted as an appropriate representation of the factor structure for the MCSQ-21.

Model based reliability coefficient Ω_H (McDonald, 1999; Zinbard, Revelle, Yovel, & Li, 2005), obtained for the MCSQ-21 general factor in the calibration sample, was .77. This represents a very small reduction in estimated measurement reliability in comparison to the .80 obtained for the MSCQ-40 with the same sample of subjects.

Convergent and Concurrent Validity – MCSQ-21

Theoretical Background, and Predictions

As was pointed out at the beginning of our article, we predicted that MCS serves self-regulatory functions via intrinsic motivation (we cal MCS functions as „intrinsically motivated self-regulation"). Thus, it is plausible to expect positive correlations between MCSQ-21 and questionnaires, indicating the positive impact of metacognition on motivated human social functioning, as well as negative correlations (or no correlation) between MCSQ-21 and maladaptive metacognition.

The Integrative Self-Knowledge Scale (ISK) (Ghorbani, Watson, & Hargins, 2008) and its extracted three subscales (1. Future-oriented self and goal – directed behavior; 2. Awareness of the self in the present; 3. Understanding past experience) were mostly predicted to correlate positively with MCSQ- 21. ISK is focused on self- integrity over time, that

indicated motivation for consistency. Moreover, ISK pertains to a healthy personality characterized by the construction of a stable and coherent sense of self. People are naturally motivated to synthesize their psychic elements into a unified self. The process maintains the stability and coherence of a person's conceptual self- system, which is basic for intrinsically motivated self- regulation. Ghorbani et al. (2008) defined integrative self-knowledge "as an adaptive and empowering attempt of the self to understand its experience across time to achieve desired outcomes" (p. 397). Hence, ISK was positively associated with a sense of personal identity, a need for cognition, and reflection, and was negatively correlated with self-incoherence (Ghorbani et al., 2008; Pilarska, 2016). We predicted a positive correlation between MCSQ-21 and ISK subscales: achieving desired goals in the future; and understanding the past. Both subscales demand intrinsic motivation, and cognitive engagement. However, we did not expect any positive correlation between MCSQ-21 and the ISK subscale: awareness of the self in the present. Our reasoning is supported by the results showing that the MCS relation to the occurrence of explicit biases in real behavior is moderated by impact of a low ability to achieve cognitive structuring (Bar-Tal, et al., 2018). This means that high MCS individuals need much more time to understand a present situation than their low MCS counterparts. Moreover, ISK is positively correlated with successful fulfillment of a need for closure (Pilarska, 2016). Need for closure is a reverse phenomenon in relation to a low ability to achieve cognitive structuring (Bar-Tal, 1994). Both pieces of evidence shed light on the cognitive functioning of high MCS individuals. High MCS counterparts - more than their low MCS ones - prefer to take time over choosing any activity. Therefore, we predict no correlation or even negative correlation between self- awareness of the ISK subfactor "present" and MCSQ-21.

Convergent validity of MCSQ-21 was predicted mostly via positive correlations between MCSQ-21 and ISK motivational subscales: 1 (goal-directed behavior).

The other instrument chosen to support the convergent validity of the presented instrument MCSQ-21 was the Positive Metacognitions and Positive Meta-Emotions Questionnaire (PMCEQ) (Beer & Moneta, 2010), which measures adaptive metacognitive beliefs. Beer and Moneta (2010) identified adaptive metacognitive beliefs equipped with motivational potential, that foster success in facing challenging situations among highly self-regulated and resilient individuals. Thematic analysis revealed three main metacognitive factors that helped them to manage challenges successfully: (1) Confidence in Extinguishing Perseverative Thoughts and Emotions; (2) Confidence in Interpreting Own Emotions as Cues, Restraining oneself from Immediate Reaction, and Mind Setting for Problem Solving; and (3) Confidence in Setting Flexible and Feasible Hierarchies of Goals. The authors meant by factor 1: awareness of the need to free up attention resources and experience positive emotions; by factor 2: confidence in interpreting emotions as cues that help to solve a problem; by factor 3: confidence in systematizing the hierarchy of goals from elementary to final ones. It might be suspected that subscales 2 and 3 as they are motivational, will be positively correlated with MCSQ-21. With regard to subscale no. 1, we did not predict a correlation between attention and metacognitive self. Moreover PMCEQ, factor 1 indicates "Confidence in Extinguishing Perseverative Thoughts and Emotions". We wonder whether factor 1 may be correlated positively or negatively with MCSQ-21. The theory of MCS is not related to perseveration of thoughts.

Another instrument often used for counting both convergent and concurrent validity is that which measures the Big Five Personality Traits (Goldberg, 1992). We choose a questionnaire (Strus, Cieciuch, & Rowiński, 2014) that assesses five personality factors: extraversion; agreeableness; conscientiousness; emotional stability; and intellect/imagination. The prediction was that MCSQ-21 will positively correlate with conscientiousness and agreeableness. Both personality traits are very adaptive in social functioning and facilitate

motivation and self- regulation. Moreover, we supposed that MCSQ-21 will positively correlate with extraversion. The latter trait predicts a subject's assertiveness and motivation in striving for crucial life goals. Extraversion is also correlated with better social functioning. It is, however, difficult to say whether intellect is positively correlated with metacognitive self. As is shown below (paragraph "Discussion"), education has no impact on metacognitive self for a representative sample of Poles. However, education does not equal intellect or imagination. We may be simply being optimistic in searching for a positive correlation between MCSQ-21 and intellect. We also did not make a solid prediction about the relation between MCSQ-21 and emotional stability, as emotional stability does not mean motivation.

Two questionnaires (ISK; PMCEQ) measure adaptive metacognition and are used to verify the convergent validity of MCSQ-21. Moreover, a Big Five questionnaire was chosen to strengthen our predictions. Adaptive personality traits are always desirable for showing motivational and self-regulatory functions of a psychological construct like metacognitive self.

Last, we took advantage of the Metacognitive Questionnaire – 30 (MCQ-30; Wells & Cartwright-Hatton, 2004) for measuring the concurrent validity of MCSQ-21. Wells and Cartwright-Hatton (2004) created MCQ-30 to measure maladaptive metacognition. However, although Wells and Purdon (1999) define metacognition as information processing that monitors, interprets, and regulates the contents and process of its organization, the authors focused on dysfunctional metacognitive beliefs. They assert that these beliefs are the basis for the development and the maintenance of psychological disorders, such as: general anxiety disorder, hallucinations, psychosis, compulsive – obsessive symptoms, panic, and even symptom severity in chronic fatigue syndrome (Wells, 2009). The theory of maladaptive metacognition is shown to be associated with a non – specific style of thinking, that is Cognitive – Attention Syndrome (CAS). CAS consists of positive beliefs about worry and negative beliefs about worry concerning uncontrollability and danger, and beliefs about the strong need to control thoughts. CAS evidently is in opposition to healthy motivation, self-regulation and goal's striving. We predict negative correlation (or no correlation) between the subscales of MCQ-30 and MCSQ-21.

Psychometric Properties of the MCSQ-21

Method

Assessment of the psychometric properties of the MCSQ-21 consisted of a cross-validation of the bi-factor structure developed in phase one of the study, estimation of measurement reliability, and convergent and concurrent and validity.

Participants

All participants provided written informed consent to participate in the study in reference to the reviewed and approved decision by Ethics Committee for Research Projects, Institute of Psychology, University of Gdansk (no 17a/2013). A nationally representative sample of n = 600 adult Poles between the ages of 17 and 85 participated in this part of the study. Among the participants, 312 were female and 288 were male. Mean age of the female sample was M = 44.74 years (SD = 15.97) and that of the male sample was M = 46.69 years (SD = 17.10). The education structure of the sample matched that of the Polish population and comprised 20.5% participants with primary education, 24.7% with basic vocational education, 35.7% with high school education, and 19.1% with higher education.

Procedure

The sampling procedure utilized in the validation part of the study was analogous to that used in the calibration part of the study. Participants were selected randomly from the personal identity number registry. The study was commissioned to PBS Partner in Business Strategies service and paid by National Science Centre, grant 2013/11/B/HS6/01463. PBS delivered database. Interviews were conducted individually and there was no reward for participation in the project. Each participant completed a battery of questionnaires that included the MCSQ-21, the ISK, the PMCEQ, the MCQ-30, and the PIP-BFM-20 (described below). Completion of the battery took approximately 25 minutes. At the conclusion of each interview, all participants were thanked and debriefed. The study was approved by the Polish Ethical Committee as compliant with ethical standards.

Measures

The MCSQ-21 was developed in the calibration part of the study. The measure is described above. The items, translated into English, are presented in the Appendix.

The Polish version of the ISK (Pilarska, 2016) is an adaptation of the original ISK (Ghorbani, Watson, & Hargins, 2008). The 12-item instrument gauges three factors of temporarily integrated understanding of processes within the self: (1) future-oriented self-experiences and goal maintenance; (2) present-oriented self-experiences; and (3) past-oriented self-experiences. The three factors are assessed by three, four, and five items consecutively, with a 6-point response scale: 1(Strongly do not agree), 2 (Do not agree), up to 5 (Agree), 6 (Strongly agree). Consistently with the original version of the ISK, nine of the 12 items were reverse coded.

The Polish version of the PMCEQ (Konarski & Brycz, 2016) was adapted from the original version of the PMCEQ (Beer & Moneta, 2010). The PMCEQ is an 18-item instrument that assesses three factors of adaptive metacognitive beliefs: (1) Confidence in Extinguishing Perseverative Thoughts and Emotions; (2) Confidence in Interpreting Own Emotions as Cues, Restraining oneself from Immediate Reaction, and Mind Setting for Problem Solving; and (3) Confidence in Setting Flexible and Feasible Hierarchies of Goals. Each factor is measured by six items with a 4-point response scale: 1 (Do not agree), 2 (Agree slightly), 3 (Agree moderately), and 4 (Agree strongly).

The Polish version of the MCQ-30 (Dragan & Dragan, 2011) is a 30-item version of the MCQ (Cartwright-Hatton & Wells, 1997). It was developed to assess five correlated metacognitive factors: (1) Cognitive Confidence (the need for rumination); (2) Positive Beliefs about Worry; (3) Cognitive Self-consciousness; (4) Negative Beliefs about Uncontrollability of Thoughts and Danger; and (5) Beliefs about Need to Control Thoughts. Each factor is measured by six items with a 4-point response scale ranging from 1 (Do not agree) to 4 (Agree very much).

The Polish version of the IPIP-BFM-20 is a 20-item version of the Polish version of the IPIP-BFM-50 (Strus, Cieciuch, & Rowiński, 2014; Topolewska, Skimina, Strus, Cieciuch & Rowiński, 2014). The instrument assesses five personality factors: (1) Extraversion; (2) Agreeableness; (3) Conscientiousness; (4) Emotional stability; and (5) Intellect/Imagination. Each factor is measured by four self-description items with a 5-point response scale ranging from 1 (Completely inaccurate) to 5 (Completely accurate).

Results

Psychometric Analyses

The first task of this part of the current study was to cross-validate the bi-factor structure of the MCSQ-21 that was developed in the calibration phase of the study. The factor structure was evaluated by CFA for discrete indicators using Mplus 7.4 (Muthén & Muthén, 1998-2012). The CFA models were tested using the robust weighted least squares estimator (Satorra & Bentler, 1994). As in the earlier CFA analyses model, fit was assessed by two alternative fit indices (RMSEA and the CFI).

Prior to the assessment of convergent and concurrent validity of the MCSQ-21, the reliability of the measures was assessed by means of model-based reliability estimation from an appropriate CFA model estimated for each instrument.

Cross-Validation of the Factor Structure of the MCSQ-21

In order to cross-validate the factor structure of the MCSQ-21, a sequence of three consecutively more restricted CFA models was fitted to data: the bi-factor model, the correlated four-factors model, and the unidimensional-factor model. As in the calibration stage of the project, the most general model in the sequence was a confirmatory bi-factor model specifying one general "metacognitive self" factor and four group factors representing: "memory biases", "attribution biases", "social learning laws", and "social influence". The four correlated-factors model excluded the general "metacognitive self" factor, and the single-factor model excluded the four group factors representing the four areas relating to individual functioning. To compare the fit of the bi-factor model to each of the more restricted alternatives, the procedure for scaled difference testing outlined by Bryant and Satorra (2012) was followed. The results of testing the sequence of nested models are summarized in Table 3.

Table 3. Summary of model fit statistics for alternative models for the MCSQ-21 in the cross-validation sample

Model	χ^2_{SB}	*df*	$\Delta\chi^2_{SB}$	Δdf	RMSEA	CFI
Bi-factor with four group factors	825.89***	168	---	---	.082	.953
Four correlated factors	1032.83***	183	183.93***	15	.089	.940
Single-factor	1261.67***	189	440.84***	21	.099	.924

Note. N = 583. *** - $p < .001$

The top portion of Table 3 displays the fit measures for the confirmatory bi-factor model. The robust Satorra-Bentler (Satorra & Bentler, 1994) chi-square test statistic obtained for this model was χ^2_{SB} = 825.89, df = 168, $p < .001$, robust RMSEA = .082, and robust CFI = .95, indicating an acceptable fit of this model to data. The bi-factor representation of the factor structure of the MCSQ-21 served as the baseline for comparison of the other two more constrained factor representations of the structure of the instrument.

The correlated four-factors model can be considered a nested and more constrained alternative to the bi-factor model obtained by fixing the loadings of the general factor to zero and freeing the orthogonality constraint on the four group (areas of individual functioning) factors. The fit measures obtained for this model are χ^2_{SB} = 1032.83, df = 183, p < .001, robust RMSEA = .089, and robust CFI = .94, indicating a weak fit of this model to the data. Moreover, the Satorra-Bentler scaled chi-square difference test, comparing the fit of the four correlated-factors model to the fit of the bi-factor model, was $\Delta\chi^2_{SB}$ = 183.93, df = 15, p < 0.001, indicating the statistical superiority of the bi-factor model.

The final model tested was the unidimensional or a single-factor model, in which all items were allowed to load on a single common factor. As this model is nested within each of the preceding models, the fit of the model was compared to the fit of the bi-factor model. As can be seen in Table 3, the fit measures obtained for this model are χ^2_{SB} = 1261.67, df = 189, p < .001, robust RMSEA = .099, and robust CFI = .92, indicating a very weak fit to the data. Moreover, the Satorra-Bentler scaled chi-square difference test, comparing the fit of this model to the fit of the bi-factor model, was $\Delta\chi^2_{SB}$ = 440.84, df = 21, p < 0.001, indicating the statistical superiority of the bi-factor model.

The sequence of tested models conducted in the cross-validation sample confirmed the bi-factor structure of the MCSQ-21 developed in the calibration sample. The fit of the bi-factor model obtained in relation to the cross-validation data was acceptable, and each consecutive more constrained alternative model represented a significant decline in model fit. Moreover, because the substantive goals of the study justified the acceptance of the bi-factor model, this model was accepted as an adequate representation of the structure of the MCSQ-21. Factor loadings of the bi-factor model are presented in Table 4.

Table 4. Factor loadings with standard errors (in parentheses) for the bi-factor model for the MCSQ-21 (validation sample)

MSQ item	MSQ-F1	MSQ-F2	MSQ-F3	MSQ-F4	MSQ
I7	.690 (.093)***				.355*** (.036)
I8	.308 (.049)***				.526*** (.031)
I6	.280 (.039)***				.604*** (.026)
I2		.600*** (.076)			.464*** (.034)
I1		.380*** (.052)			.531*** (.029)
I3		.208*** (.054)			.385*** (.035)
I10		.140** (.053)			.538*** (.031)
I24		.132* (.051)			.576*** (.028)
I9		.059 (.054)			.449*** (.031)
I17			.579*** (.149)		.489*** (.030)
I12			.220** (.067)		.608*** (.027)
I11			.197** (.070)		.409*** (.031)
I16			.146* (.058)		.504*** (.031)

I13		.417*** (.031)
I14		.492*** (.031)
I22	.563*** (.067)	.590*** (.029)
I21	.379*** (.053)	.505*** (.031)
I20	.267*** (.043)	.533*** (.029)
I18	.128** (.047)	.610*** (.027)
I4		.477*** (.030)
I5		.455*** (.031)

Note. $N = 583$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

As can be seen in Table 4, all factor loading for the general factor are statistically significant with the lowest loading equal to .355 (item I7), the highest loading equal to .610 (item 18), and the average loading equal to .501. Moreover, for 18 of the 21 items that comprise the scale factor, loading for the general factor exceeds the corresponding factor loading for the content factor. Finally, 16 of the 21 content factor loadings are statistically significant (see Table 4).

Reliability of the Measures

The estimates of the reliability coefficients obtained for the measures used in this part of the study are reported in Table 5. For the MCSQ-21, a general factor ordinal reliability coefficient omega H was obtained, utilizing the estimated factor loadings presented in Table 4. However, for the remaining instruments, ordinal reliability omega coefficients were obtained on the bases of an appropriate CFA multi-factor model (McDonald, 1999; Zinbard, Revelle, Yovel, & Li, 2005). As can be seen in the first row of Table 5, measurement reliability of the MCSQ-21 is acceptable and equals .90, which is fairly close to the reliability of .77 obtained in the calibration sample. For the remaining measures, the reliability indices range from 0.66 to 0.88. Overall, the highest reliability was obtained for the 5 MCQ-30 factors (MCQ-30-F1 to MCQ-30-F5), whereas the lowest levels of reliability were obtained for the five personality factors (IPIP-BFM-20-F1 to IPIP-BFM-20-F5), which can be explained by the relatively short (4-item) subscales of the IPIP-BFM-20.

Assessment of Convergent and Concurrent Validity of the MCSQ-21

As has been indicated in the introduction, convergent validity was assessed by correlating the total MCSQ-21 score with such measures of highly related metacognitive constructs as "confidence in interpreting emotions as cues that help to solve a problem" and "confidence in systematizing the hierarchy of goals", as assessed consecutively by factor 2 (PMCEQ-F2) and factor 3 (PMCEQ-F3) of the PMCEQ, and ISK, which assesses "future (goal)-oriented self-experiences".

Table 5. Validity correlation coefficients corrected for attenuation, reliability coefficients and descriptive statistics

Validity evidence	Measure	Correlations	Omega	Alpha	Mean	SD
	MCSQ-21	1.000	.897	.880	4.305	0.574
Convergent	PMCEQ-F1	-.408**	.739	.733	2.849	0.496
	PMCEQ-F2	.528**	.753	.748	2.965	0.451
	PMCEQ-F3	.438**	.796	.801	2.939	0.471
	ISK-F1	.651**	.784	.780	4.354	0.847
	ISK-F2	-.159**	.726	.723	3.545	0.888
	ISK-F3	.007	.862	.861	3.270	0.943
Concurrent	MCQ-30-F1	-.120*	.876	.875	2.342	0.646
	MCQ-30-F2	-.055	.861	.860	2.180	0.612
	MCQ-30-F3	.174**	.753	.740	2.651	0.502
	MCQ-30-F4	-.072	.818	.810	2.432	0.618
	MCQ-30-F5	-.026	.738	.734	2.526	0.542
	IPIP-BFM-20-F1	-.030	.655	.652	2.855	0.702
	IPIP-BFM-20-F2	.191**	.735	.728	3.330	0.765
	IPIP-BFM-20-F3	.286**	.700	.682	3.591	0.690
	IPIP-BFM-20-F4	.260**	.706	.691	2.696	0.763
	IPIP-BFM-20-F5	-.110*	.698	.696	3.345	0.723

Note. N = 600; *p < .05, ** p < .001 for uncorrected correlation coefficients. Alpha is reported only for comparison.

Concurrent validity was assessed by correlating the total MCSQ-21 score with measures of consciousness, agreeableness, and extraversion, as measured consecutively by factor 1 (IPIP-BFM-20-F1), factor 2 (IPIP-BFM-20-F2), and factor 3 (IPIP-BFM-20-F3) of the IPIP-BFM-20, and with such measures of maladaptive metacognition as "cognitive confidence" (MCQ-30-F1), "positive beliefs about worry" (MCQ-30-F2), and "cognitive self-consciousness" (MCQ-30-F3), as assessed by the three factors of the MCQ-30.

Validity coefficients corrected for attenuation (McDonald, 1999) are shown in Table 5. With respect to convergent validity coefficients, as predicted, the MCSQ-21 total score had strong and positive correlation with PMCEQ-F2 (r = .53) and PMCEQ-F3 (r = .44) and ISK-F1 (r = .65). According to our predictions, the higher MCS is, the more people create a systematized goal system (PMCEQ-F3), and the more confident they are in interpreting emotions as cues that help to solve a problem (PMCEQ-F2). Moreover, the predicted positive correlations between the MCSQ-21 and ISK-F1 (future and goal-oriented self- experiences) and the negative correlation with ISK-2 (present – oriented self – experience) have been confirmed. It is not clear why the predicted positive correlation between MCSQ-21 and ISK-F3 (past experience) has not occurred. With respect to concurrent validity coefficients, the predicted positive correlations between the MCSQ-21 total score and IPIP-BFM-20-F2 (r =

.19), IPIP-BFM-20-F3 (r = .29), and IPIP-BFM-20-F4 (r = .26) have been confirmed. The higher the MCS, the more conscious, agreeable, and emotional stable the individual seems to be. Moreover, as we expected, the higher the MCS an individual possesses, the more he or she is motivated: goal-oriented, future-oriented, creating a better systematized goal system, and possessing self-insight into his/her emotions as cues to solve a problem.

On the other hand, the lower the MCS, the better present–oriented self- experience is, and the better an awareness there is of the need to free up attention resources and experience positive emotions.

Concurrent validity is partially supported. As can be seen in Table 5, the predicted negative correlation between the MCSQ-21 total score and MCQ-30-F1 (r = -.12) is not strong, but significant. This means that the higher the MCS, the lower is the tendency to ruminate over unwanted thoughts. We did not find other significant correlations between the MCSQ-21 total score and MCQ-30-F2 (r = -.06), MCQ-30-F4 (r = - 0.07). MCQ-30-F5 (r = 0.03). The lack of correlations serves as partial confirmation of our predictions. MCS is not related to other unhealthy subscales of MCSQ-30. We found only one exception: a positive correlation between MCSQ-21 and MCQ-30-F3 (r = 0.17). That means that the higher the MCS, the more people are interested in accuracy and in the reliability of their judgments about their attention and memory. The result does not seem contradict previous theoretical reasoning on motivation. We expected that high MCS individuals would have to stay vigilant (not hyper-vigilant) toward themselves.

Discussion

Metacognitive self (MCS) is presented as intrinsically motivated self-awareness of biases (the role of motivation: Higgins & Kruglanski, 2000, Herrmann & Brandstatter, 2015, Gendolla & Wright, 2018, Queen & Hess, 2018). The adjective "metacognitive" pertains to secondary thoughts about adaptive biases. The noun "self" indicates the real object of such metacognitive thoughts: "the self". In other words, we are looking at the structure of meta-beliefs about the self. These beliefs contain more or less accurate (we know the level of the accuracy of the given belief) knowledge as to what extent biases or psychological rules that guide human behavior pertain to "the self". Moreover, we indicated that metacognitive self triggers special experience and serves intrinsically motivated self- regulatory functions.

We also wanted to introduce instruments that measure metacognitive self. The initial version of the MCS tool was made up of 40 test items grouped into 6 substantial areas related to: memory (4 items), attribution and heuristics (7 items), great laws of psychology (10 items), information about agency and morality (4 items), social influence (8 items), and persuasion (7 items). The test items have been classified based on an analysis of their content. It is known that psychological rules called biases (also called deviations from rationality in common thinking) are omnipresent in both social and psychological human functioning. What follows is that they can be clustered into certain substantial areas used by scientific psychology. Here are examples of each of the six areas: for the memory – "I remember information better when I can relate it to the knowledge I already have" (a manifestation of the generativity of memory; MCSQ-40, item #8; MCSQ-21, item #6); for attribution and heuristics, i.e., rules of reasoning about other people – "I think that causes are similar to their effects. When I realize that some event such as an international conflict is very complex, I think that it was brought about by many causes - economic, geopolitical, cultural, etc." (the function of the representativeness heuristic – looking for multiple reasons when explaining complex events; MCSQ-40, item #14; MCSQ-21, item #10); for the great laws of psychology – "I don't like people, phenomena or even food dishes that in the past I associated with something unpleasant" (classical conditioning; MCSQ-40, item #18; MCSQ-21, item #11);

for information about community vs. agency – "In important moral matters I am uncompromising towards people. I will judge a murderer negatively although I know that he once saved the life of a drowning child" (the role of the high valence of events when forming moral judgments; MCSQ-40, item #3; MCSQ-24, item #3); for social influence, i.e., reciprocity rules that govern how behaviors and emotions are changed or maintained (so-called social glue) – "When someone gives me a gift, I repay in a similar manner" (the reciprocity principle; MCSQ-40, item #37; MCSQ-21, item #19). Measuring metacognitive self in the six content areas assumes a bi-factor structure. Although the authors assume a single-factor structure of MCS, the result of measuring this construct in different substantial areas is that part of the shared variance (covariance) of the test items is determined by the common construct (metacognitive self), and another part is determined by the shared content of test items. In consequence, we can expect a four-factor structure of the tool that mirrors four substantial areas on the first level, and one factor that mirrors the construct of metacognitive self on a higher level of the bi-structure analysis.

We successfully explored the structure of metacognitive self (N = 600). According to the theoretical model of MCS that argues that it serves adaptive purposes and is a homogeneous construct, we obtained a single factor of the metaknowledge of self, consisting of 21 items. We isolated a hierarchical factorial structure that fitted the data well (fit to the validation data set: χ^2 = 969,97; df = 246; p < 0,001; RMSEA = 0,065; CFI = 0,903) with four factors making up one main factor: MCS. Factor explain only 28.1% of variance. What is more, these factors group biases, psychological rules in terms of which areas of human functioning they belong to. If we understand MCS as a human disposition, we cannot – for example – treat the laws of memory as separate from social proto-influence, which, in turn, cannot be detached from how heuristics work. This is why it is not surprising that the subscales have little reliability, while the reliability of the entire MCSQ-21 scale is high.

When presenting the shortened version of the tool measuring MCS, we do not reevaluate its theoretical validity, which has already been established well for the MCSQ-40 version (Brycz & Karasiewicz, 2011). The results of theoretical validity analysis indicate that MCS does not correlate with Rosenberg's scale, and therefore meets the requirement of neutrality in relation to self-esteem. Items of MCSQ-40 include no ego-threatening content, which is why MCS is resistant to distortions resulting from impression management. MCS was found to be significantly correlated with extroversion and agreeableness. Moreover, under conditions of active discrepancy between ideal Self vs. real Self and of the Self-others discrepancy (Higgins, 1996), the MCS score is significantly lower than under conditions of active group Self, and when estimating the discrepancy between Self and other nations (Brycz & Karsiewicz, 2011).

In addition, the described present study revealed that the relationship between MCS and education and gender do not exist. Brycz and Karasiewicz (2011) found that the role of education for MCS appears to be virtual – the real factor correlating with MCS was the attitude of self-knowledge, i.e., the tendency for self-insight and intraception, which is more often characteristic of women than men (Showers & Kling, 1996). A statistically significant difference appeared between the average scores of metacognitive self obtained in the groups of women (M = 50.97, SD = 9.85) and men (M = 48.94, SD = 10.07), t(1184) = 3.45; p < .001 (Brycz & Karsiewicz, 2011). However we did not replicate the gender difference on validation group (N = 600): women M = 3.06, SD = 0.59 vs. men M = 2.94, SD = 0.60, t(592) = .303; p = .762. What is more, the study revealed that the correlation between metacognitive self and the age of participants proved to be statistically insignificant: r = .009; p > .80. Level of education does not make a difference in the metacognitive self scores either, F(4, 595) = 0.79; p > .50. This fact supports the assumption that it is the MCS is relatively independent of participant's gender, age or education, which translates into higher MCS scores. The result on

gender difference obtained by Brycz & Karsiewicz (2011) is in keeping with international studies which noted higher measures of metacognition in women than men. For example, Kolić-Vehovec, Bajšanski and Zubković (2010) used longitudinal studies to demonstrate that high-school girls were quicker to acquire metacognitive strategies of learning than high-school boys. Similarly, de Acedo Lizarraga and de Acedo Baquedano (2013) examined 360 women and men from the University of Navarra with the Scale of Metacognitive Creativity and found slightly higher scores among women, as compared to men. Presented in this article studies don't support the findings.

Moreover, the convergent and concurrent validity of MCSQ-21 added new support to our thesis on the MCS intrinsically motivated self-regulatory function. The more metacognitive self a person has, the more available for him/her is "confidence in interpreting emotions as cues that help to solve a problem" and "confidence in systematizing the hierarchy of goals" (Beer & Moneta, 2010), as well as "future-oriented self- and goal–directed behavior" (Ghorbani, et. al., 2008; de Ridder, Kroese, & Gillebaart, 2018). In addition, there is more agreeableness, consciousness, extraversion, intellect (Big Five), and deeper processing of one's own accuracy (MCQ-30, F3). All these traits, metacognitive adaptive features, confirm our thesis on the intrinsically motivated self- regulatory functions of MCS. Further support for this argument flows from no (or negative) correlations between MCS and maladaptive metacognition (Wells, et al., 1996).

Metacognitive self as self- awareness of biases may be also understood as a human ability to perceive the functioning of psychological rules, biases, illusions, and deviations from irrationality in one's behavior. The more accurate the self- awareness (MCS), the more the individual motivational benefits. Previous studies have demonstrated that MCS has important self-regulatory functions. It seems that by creating a new shorter tool, MCSQ-21, researchers can now accurately test individual differences in terms of metacognitive self. The instrument makes it possible to differentiate how high- and low-MCS individuals function in different areas of social life, what their individual intrinsically motivated self-regulation looks like, whether they are persistent in pursuing their goals, and, when confronted with physical inconveniences, if they are internally motivated, autonomous, and thinking reflexively. Additionally, metacognitive self can become a construct that helps to understand how a person transgresses the actor-observer asymmetry in one's own perception (Weiner, 2018).

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Electronic Supplementary Material

The electronic supplementary materials are available at http://dx.doi.org/10.17605/OSF.IO/EWZYG

ESM 1. Data 1
Raw data from study 1 in SAV format.
ESM 2. Data 2
Raw data from study 2 in SAV format.
ESM 3. Table (DOCX)
English version of the MCSQ-21 in MS Word format.
ESM 4. Table (Pages)
English version of the MCSQ-21 in Mac OSX Pages format.
ESM 5. Table (PDF)

English version of the MCSQ-21 in PDF format.

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