Original Papers

Polish Psychological Bulletin
2018, vol. 49(1) 66–76
DOI - 10.24425/119473

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The metacognitive self fosters the drive for self-knowledge: The role of the metacognitive self in the motivation to search for diagnostic information about the self

Abstract: *We presented 3 studies on the relation between metacognitive self, that is self- awareness of biases, and the drive to posses information that is diagnostic about the outcome. First study (N=184) showed that high MCS participants sought self- diagnostic information significantly more often then their low MCS counter partners. Second study is devoted to the development of the new measure SDMS (N = 555), that is the motive to look for self – diagnostic information. The last study (N = 90) presented that high MCS participants in contrary to low MCS ones, posses higher drive for looking self- diagnostic information when feedback about the outcome is negative.*
We discuss the results in line with Taylor & Brown (1988) reasoning on self- regulatory functions of biases.

Keywords: *biases, metacognition, self, motivation, diagnostic information*

Metacognition

Metacognition is usually described as our knowledge about our own cognition including the use of this knowledge to regulate our own cognitive processes (Weinert & Kluwe, 1987). Motivation captures useful ways of thinking about metacognition: people strive to get a first glance of a problem or a perceived person, which is primary thought, meaning a direct level of cognition – "That car is beige" or "I'm shy" (object level thoughts, Nelson & Narens, 1990). However, primary thoughts are not enough to understand the social world and the self. Lun, Sinclair, Whitchurch, and Glenn (2007) point out the need (or desire) to acquire accurate knowledge, which means systematic piecemeal information processing. The need to be accurate compels secondary thoughts involving reflections on primary thoughts – "Is that car really beige or is it tan?" or "Am I really shy?" Secondary thoughts assert about the metacognitive level of information processing (Brinol & DeMarree, 2012). These magnify, attenuate, or reverse the impact of primary thoughts, produce changes in thoughts, feelings, and behavior, and they are critical for understanding human behavior.

Dunlosky & Metcalfe (2009) distinguish the fields of research concerning metacognition. They address metacognitive knowledge that refers to people's beliefs about thinking (lay theories). Another thread concerns metacognitive monitoring that allows people to evaluate their own thoughts with respect to some thought standard (how does my mood impact my decision?). Koriat (2006) describes metacognitive monitoring as the subjective assessment of one's own cognitive processes and knowledge. The third ramification pertains to metacognitive control that permits regulating one's own thinking (my mood might be biasing my thinking, so I might want to be less positive as a judge). Thus, metacognitive control refers to processes that regulate cognition and behavior.

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This research was sponsored by the Polish National Centre for Science 2013/11/B/SH6/01463.
All studies were approved by the Polish Ethical Committee as compliant with ethical principles.
We extend our thanks Marta Knycinska for her help in gathering the data for Study 3.

Metacognition research is prevalent throughout the fields of psychology, and it can be found in works on neurocognition (Davies, Fowler, & Greenwood, 2017), working memory (van den Berg, Yoo, & Ma, 2017); judgments (Undorf & Zander, 2017), decision-making (Parker & Fischhoff, 2005), children's cognitive development (Flavell, 1979; Swanson, 1990), problem solving (Kontos & Nicholas, 1986), learning (McCormick, 2003), critical thinking processes (Takana & Kusumi, 2007), and many others. We are interested in the interplay between metacognition and the self-awareness of bias. Paul Klaczynski (2006) revealed that people who acquire new information might engage in metacognitive intercession that reduces reasoning bias.

Wegener and Petty (1995) focused on metacognition relevant to bias perception and motivation to be accurate, and they created the well-known Flexible Correction Model (FCM). FCM explains the role of naïve theories in the correction of perceived bias. The authors claim that people who are both motivated and able to correct their assessment in light of the given biasing factor adjust their judgment "in a direction opposite to that of the perceived bias and in an amount of commensurate with the perceived amount of bias" (Wegener & Petty, 1995, p. 40). FCM pertains to corrections that are aimed at removing perceived bias rather than actual bias.

Wegener and Petty (1995) presented four elegant experiments showing that one kind of naïve theory of biases (the naïve theory of default influence of contrast vs. assimilation in judgmental processes) together with an aroused motivation for correcting bias (operationalized via aroused motivation by making primes salient before judgments vs. no instruction equals no motivation) worked within the FCM hypothesis. The authors achieved an interaction effect between the kind of naïve theory (contrast vs. assimilation) and the drive to correct the shift of the target's ratings, which refers to a shift in ratings induced by the context and by the correction process (e.g., study 3). In other words, the participants who used the naïve theory of default contrast were more positive than those who did not use the theory of default contrast (correction opposite to contrast effects). Analogously, these subjects who were guided by the naïve theory of default assimilation were more negative than those who did not use the theory of default assimilation (correction opposite to assimilation effect).

Wegener, Kerr, Fleming, and Petty (2000) verified and proved the realm of FCM via the drive to correct bias in a juristic environment.

Thus, some metacognitive scientists focus on bias correction and the accuracy of judgments. However, the metacognitive self concept described beneath this is rooted in accuracy vs. biases research and is not a replication of the proces of bioas correction.

Motivation as a base for the metacognitive self

The need to acquire accurate knowledge about one's own biases or psychological regularities (like the Yerkes-Dodson laws) can result in metacognitive knowledge about the self. In other words, the metacognitive self (MCS) is the self-awareness of certain biases (Brycz & Karasiewicz, 2011). The biases in question are favorable for human functioning (Taylor & Brown, 1988). A weak need to acquire accurate knowledge about one's own biases implies a weak metacognitive self, while a high need can (but not necessarily) compel one to achieve a strong metacognitive self. Achieving a strong metacognitive self requires special cognitive abilities like flexibility in attributional perspective change (actor-observer, Brycz et al., 2014). Thus, MCS depends on the motivation to achieve accurate self-insight into one's own biases and psychological regularity. Moreover, MCS focuses on the self and serves important self-regulative functions. High MCS facilitates the following:

- helps to attain goals while the ego is depleted;
- helps in resisting dysfunctional temptations and does not delete biases out of behavior – on the contrary, it slightly increases the tendency to express adaptive biases during performance;
- is accurate knowledge about the self – it is probably reflectively acquired over long periods of time, then it becomes subliminal or simultaneously reflective or unreflective knowledge about the self (Brycz & Karasiewicz, 2011).

A special instrument was created to measure MCS, namely the MCSQ-40 scale developed by Brycz and Karasiewicz (2011). The instrument achieves a good level of validity and reliability, which is why we used the MCSQ-40 in our studies. The scale comprises 40 items, each of which presents a bias in the form of episodic behavior (deviations from rational thinking; Kahneman & Tversky, 1996). For example: "I tend to judge other people positively rather than negatively" (positivity bias); "TV commercials really influence my choices and I buy advertised products more often" (mere-exposure effect); "If something or someone from the outside forces me to change my behavior, my views concerning this behavior also change" (forced conformity). Respondents answer using a six-point scale ranging from 1 "this does not describe me at all" to 6 "it describes me completely". The Cronbach's α in study 1 is $\alpha = 0.79$, and in study 3 it is $\alpha = 0.81$.

Motivation to seek self-diagnostic information

Self-motives are important factors that influence human motivation and behavior. The interplay between self-enhancement, self-verification, self-assessment, and self-improvement stands behind various human needs and acts. The model that integrates different research mainstreams in the self-motive tradition is the SCENT *Self-Concept Enhancing Tactician Model* (Sedikides & Strube, 1997). It can be also used to determine the influence of self-motives on the process of searching for feedback. According to its assumptions, the pursuit of feedback is affected by motives and acquiring knowledge about how they work, and determining which individual and situational conditions activate them can help to understand the process. For example, it occurs that individuals prefer accurate feedback when they are about to make a decision,

but they favor positive information about themselves when they have already made it (Gollwitzer & Kinney, 1989). In accordance with the SCENT model, self-motives can also sometimes be activated simultaneously and interact with each other. For example, the self-assessment motive and the self-improvement motive function as an interactive couple of motives connected with the process of gaining knowledge about oneself. The first one aims at obtaining information about what is the present characteristic of an individual, while the second focuses on searching for indices on how can it be improved in the future (Sedikides & Skowronski 2000, 2009). It is difficult to imagine the effective functioning of the self-improvement motive without accurate pieces of information concerning the present state. At the same time the opposite relation is possible; individuals may need to strive for self-improvement to really get to know themselves and their limits.

The research of Trope and Neter (1994), among others, focused on the role of positive experience in searching for diagnostic information and was based on a procedure of giving the study participants positive or negative feedback on an exemplary task or on inducing in them a positive or negative mood. The results showed that individuals who received feedback about their failure or who were in a negative mood in the next step preferred self-enhancing information, while participants who were informed about their success or who were in a positive mood showed a clear tendency toward constructive information about the self, and focused on their weak points, which could serve as a basis for self-improvement.

Using a diagnostic strategy in the search for information consists in asking highly diagnostic questions and in preferring highly diagnostic tasks. Moreover, a diagnostic orientation is shown by the same interest in favorable and unfavorable pieces of information concerning oneself (Landau, Greenberg, & Kostloff, 2010). However, as most research results indicate, at best individuals prefer information that is simultaneously diagnostic and positive (Morrison & Cummings, 1992).

According to metacognition theory, we examine the cognitive core of MCS (Bar-Tal, Brycz, Dolinska, & Dolinski, 2017) as well as on the motivational aspects of MCS. It is interesting whether MCS can predict the need for searching for information about one's own behavior, and what kind of information about the self high MCS individuals are looking for. It is predicted in our studies that high MCS (in contrast to low MCS) subjects appear to strive strongly for information about the self in general (study 1). If this is so, another question arises: do high MCS participants look more than low MCS counter partners for diagnostic information about the self, especially when feedback is negative? Adaptive metacognition offers protection against emotional pain in the face of negative feedback (Beer & Moneta, 2010). MCS as a cognitive construct based on the self-knowledge of adaptive biases may serve the same role. We predict that high MCS individuals will strive more for diagnostic information about the self than do low MCS individuals (study 3). It seems essential to understand what kind of information about the self is really diagnostic. This is why a new instrument measuring self-diagnostic motives was created (study 2).

The logic of our three studies is as follows. First, it is valuable to verify the hypothesis that high MCS participants are endowed with a higher degree of motivation for obtaining information about the self in general (e.g., how well did they perform a test?) than are their low MCS counterparts (study 1). Second, a new tool for measuring self-diagnostic motivation was created (study 2). Third, it is important to learn whether high MCS individuals are more eager to search for diagnostic information about the self when feedback is negative (study 3).

Study 1. The metacognitive self and the search for diagnostic information about one's own test results

According to previously obtained results (Wyszomirska-Góra & Brycz, 2014), individuals with a strong metacognitive self are more interested in information about their test results in a social domain than are low metacognitive self individuals. In the present study we wanted to verify the influence of the metacognitive self on the willingness to receive information about one's score on a test of logical thinking abilities. Participants completed the MCSQ-40. Afterward, we created two conditions in which we manipulated the emotional load the participants experienced while reading the instructions. The experimental group was informed that the study was a part of a national program to verify the logical thinking abilities of students of various disciplines. At the same time, the control group was informed that the aim of the study was only to verify the credibility of a new questionnaire (which, in fact, did not exist). According to our hypotheses, the high metacognitive self individuals should be more interested in diagnostic pieces of information about their task results than low metacognitive self individuals. This effect should take place in the experimental group which offers diagnostic information concerning one's results contrary to the control group. Therefore, we assumed that high metacognitive self individuals would seek information more often than low metacognitive self individuals, but only in the experimental group.

Subjects

The 148 participants (57 males, 91 females) who participated in the study were undergraduate students of the Economics Department of Gdańsk University, aged between 18 to 28 years ($M = 20.96$; $SD = 1.13$). All of them were informed about the anonymity of the study and its scientific goal. The students worked individually in a laboratory. No compensation was offered for participation. At the end of the study, all of the students were thanked and fully debriefed.

Procedure

Initially, the participants were asked to complete the MCS-40 scale, and they were informed that this test was unrelated to the rest of the study. After a short break, they were randomly assigned to one of the two research groups, either the experimental group or the control group. The experimental group was informed that the aim of the research was to assess their level of logical thinking abilities as a part of a national program to collect data in this field. This manipulation was supposed to make the participants feel like they were being compared to others and assessed. Next, they were informed that they were about to solve a test concerning logical thinking abilities (part D of the Raven scale). At the end of the test they were also asked to make a self-assessment concerning their performance on a scale of 1–6 (1 – very poor, 6 – very good). In the last part of the study the participants were asked whether they would like to receive information about their scores (simple measure: yes or no). The procedure applied in the control group was very similar; the only difference was that the subjects were informed that the aim of the research they were participating in was only to verify the quality of a new questionnaire (participants thought that part D of the Raven scale was a part of this new questionnaire). This manipulation was supposed to distract their attention from being compared and assessed. In the end, the subjects were also asked to make a self-assessment about their performance, and they were asked if they wanted information about their test results (simple measure: yes or no).

The real results of the Raven part D test were calculated separately for each individual. However, this information was not made available to the participants; it served only for the purposes of our investigation.

Independent measures: MCSQ-40 mean score for each participant x manipulation: the feeling of being compared and assessed (the diagnosticity of the test results) vs. the lack of this kind of feeling.

Self-assessment concerning their performance on a 1–6 scale (1 – very poor, 6 – very good)

Dependent variables: willingness to obtain feedback from the test (yes or no)

Detailed predictions are given below:

H1: Participants from the experimental group will seek information about the self more often than participants from the control group (manipulation check).

H2: High metacognitive self individuals will seek information about the self more often than low metacognitive self individuals in the experimental group.

H3: There will be no impact of the metacognitive self on the willingness to receive information about the self in the control group.

H4: Individuals with a high self-assessment of their score will seek information about the self more often than individuals with a low self-assessment of their score in the experimental group.

H5: The self-assessment of one's score will have no effect on seeking information about the self in the control group.

H6: The correctness of the individual's results will have no effect on the willingness of participants to receive information about the self in either of the groups.

Results

The impact of the manipulation (Hypothesis 1) was significant. Participants from the experimental group wanted information about themselves more often than the participants from the control group. The feeling of being assessed and compared increased the diagnosticity and the importance of feedback (Chi-square = 20.006, $p < 0.001$).

Table 1. Descriptive statistics

N = 148	Mean value	Standard deviation
MCS	58.42	9.01
Self-assessment of one's results	4.29	1.01
Correctness of one's results	9.48	1.74
Seeking information about one's self	1.51	0.50

Table 2. Frequency of feedback seeking between groups

Group	Yes	No	Total
Control	20	49	69
Experimental	52	27	79
Total	72	76	148

Because our dependent measure was dichotomous (yes or no), we chose to use logistic regression to analyze the results (SPSS.21). The effect of the metacognitive self was significant on the frequency of seeking information about the self in comparison to the control group (hypotheses 2 and 3). The b coefficient for the metacognitve self was negative, which indicated that a high metacognitive self was associated with increased interest in information about the self. When information was diagnostic, the high metacognitive self individuals were more interested in it than were the low metacognitive self individuals. In the experimental group the self-assessment of one's results had a significant effect on the willingness of the participants to receive information about their results, which was in contrast to the control group (hypothesis 4). According to b coefficient, the higher the self-assessment of one's results, the more often individuals wanted to receive information about their own results, which corresponds with the self-enhancement motive. The effect of the correctness of one's results on the willingness to obtain information was insignificant in contrast to the self-assessment of the results, which showed that the self-assessment of one's results was true. No significant effects were observed in the control group, which indicates that the information about the test results was not diagnostic enough, and, therefore, less attractive for the participants (hypotheses 5 and 6).

Table 3. Regression analysis for feedback seeking

Group	B	Se	Wald	Df	Sig.	Exp(B)
Experimental MCS	-.084	.035	5.738	1	.017	.919
Self-assessment	-.843	.365	5.340	1	.021	.430
Correctness	-.200	.199	1.008	1	.315	1.222
Control MCS	-.052	.030	3.074	1	.080	.949
Self-assessment	-.114	.266	.185	1	.667	.892
Correctness	-.085	.185	.212	1	.645	.918

Table 4. Correlations between variables for regression analysis

N = 148	MCS	Self--assessment (1)	Correctness (2)	Information (3)
MCS	X	-.065	-.008	-.209*
1		X	.377**	-.235**
2			X	-.237**
3				X

** $p < 0.01$, * $p < 0.005$

Discussion

The most important result is the one proving that high MCS participants sought diagnostic information about the self (the diagnostic situation was created only by the experimental condition) significantly more often than did low MCS individuals. Experimental manipulation only acted to induce higher motivation for searching for information about the self. Moreover, the dependent measure was very simple: we only asked whether the participants wanted to obtain information about their results or not. It is necessary to replicate the effect of stronger motivation in the case of high MCS vs. low MCS in a more sophisticated experiment. For this reason, it is important to create a valid dependent measure that will directly indicate to what extent a person is motivated to search for diagnostic information about the self. We undertook this task in study 2.

Study 2. The creation of a dependent measure: The Self-Diagnostic Motive Scale (SDMS)

The need to create a scale that could accurately measure the drive to search for diagnostic information about the self seemed inevitable. The Self-Motive Items by Gregg, Hepper, and Sedikides (2011) was not available for the Polish population during our studies. It has, however, been accessible since 2016 (Miciuk, Jankowski, & Oleś, 2016). Thus, we decided to develop our own self-motives scale that pertained mostly to self-diagnostic motives (self-assessment and self-improvement).

However, to extract perfect items and follow the self-motives theory (SCENT, Sedikides, Strube 1997, Sedikides, 1993), we created a pool of items pertaining to three self-motives: self-enhancement (e.g., "After completing a task, I look for information that asserts good things about me"); self-knowledge (e.g., "I want to know the truth about my results"); self-improvement (e.g., "I want to know what can I do to improve the level of my performance in the task") (Sedikides & Strube, 1997). The lack of a self-verification motive was intentional: people who are looking for self-diagnosticity neglect information consistent with self-knowledge. Judges assessed the accuracy of quite a number of items. Detailed analysis resulted in the form of a ten-item scale for further analysis. We expected to obtain a model that would fit a three factor solution. All items were straightforward sentences or questions about the given motive with a response scale from 1 (definitely not) to 6 (definitely yes).

Participants

The participants enrolled in the study numbered N = 555 (aged M = 20.291, SD = 2.431; 483 females and 53 males, 19 persons did not specify their gender). They were undergraduate students (including extramural ones) recruited randomly at the University of Gdansk campus.

Procedure

Initially, the students were informed about the scientific goal of the study and assured that their anonymity would be protected. They were also informed that there was no compensation for their contribution to the study. All the participants were asked to imagine that they had just completed a task, and afterwards they might ask for information about their results. Searching for the results was assured by the SDMS. The students completed the short ten-item scale. They worked in a laboratory, either individually or in small groups of up to 10 persons. All of the students completed the entire SDMS.

Then, the participants were thanked and fully debriefed.

Results

Psychometric Analyses of the SDMS

Psychometric analyses of the SDMS scale comprised item selection from an initial item pool, an assessment of the factor structure of the selected SDMS items, and an assessment of the measurement reliability for the final version of the SDMS.

Items Selection and Factor Structure of the SDMS

A sequence of confirmatory factor analyses (CFA) for discrete indicators of the structure of the SDMS items was conducted in two stages. The first stage comprised an exploratory analysis of the initial item pool of ten SDMS items conducted in a calibration sample (N = 553). The second stage comprised confirmatory analyses of the factor structure arrived at in the first exploratory stage in a validation sample

(n = 401). The CFA analyses were conducted with Mplus 7.4 (Muthen & Muthen, 1998–2012) using the WLSMV estimator with a polychoric correlation matrix.

The goal of the exploratory analyses was to select a subset of the ten SDMS items with the best psychometrics properties and to determine the factor structure of the items retained. In the first step of the analysis the theoretically predicted three-factor structure model (M0) for the initial set of ten indicators was fit to the calibration sample. Since the fit of the model (M0) was not acceptable ($\chi^2 = 829.41$, df = 32, RMSEA = .211, CFI = .963), a sequence of model modifications (model searches) was conducted that resulted in a well fitting three-factor modified model for six indicators that were retained (model M1), with items mo3 and mo4 loading on factor F1 ("Looking for one's own good and bad effects of solving the task [to establish the best way to be effective]"), items mo7 and mo8 loading on factor F2 ("Questing self-improvement information [to be better in the future]"), and items m09 and m019 loading on factor F3 ("Searching for diagnostic information about the self by comparing one's own task results to those of others"). Since the fit of the modified tree-factor model (M1) was acceptable ($\chi^2 = 12.90$, df = 6, RMSEA = .046, CFI = 1.00), a higher-order model (M2) with a single second-order general factor and second order factor loadings constrained to equality was tested. The fit of the constrained second-order model was acceptable ($\chi^2 = 10.38$, df = 8, $\Delta\chi^2 = 2.33$, Δdf = 2, RMSEA = .023, CFI = 1.00), which indicated that a hierarchical factor structure with a single general "Self-diagnostic" second-order factor for the six SDMS items retained was reasonable. In the final step of the exploratory analyses, a rival one-factor model (M3) was fit to the data demonstrating that it did not constitute an adequate model ($\chi^2 = 774.18$, df = 9, RMSEA = .393, CFA = .936) of the structure of the six SDMS items retained. The sequence of the tested models together with measures of model fit in the exploratory stage of the analysis are summarized in Table 5.

The goal of the confirmatory stage of the analysis was to cross-validate the empirically determined hierarchical factor model developed in the exploratory stage conducted in the calibration sample in an independent (validation) sample. At the first stage of the analysis, the three factor model (M1) for the six indicators retained, developed in the calibration sample, was tested, which indicated the acceptable fit ($\chi^2 = 27.94$, df = 6, RMSEA = .095, CFI = .993) of this model to the validation sample. Next, the second-order model (M2) was cross-validated ($\chi^2 = 16.01$, df = 8, $\Delta\chi^2 = 1.24$, Δdf = 2, RMSEA = .050, CFI = .998), which indicated the very good fit of this model to the validation data. Finally, the rival single factor model (M3) was tested in the cross-validation sample confirming its inadequate fit ($\chi^2 = 385.56$, df = 9, RMSEA = .323, CFI = .887) to the data. The sequence of the models tested together with measures of model fit in the confirmatory stage of the analysis is summarized in Table 5. The factor loadings for the hierarchical model (M2) obtained in the cross-validation sample are presented in Table 6, which shows that all factor loadings are relatively high and statistically significant. The mean of the estimates of the first order loadings is .87, and the estimate of the constrained second order loadings is .77, which confirm the adequacy of the hierarchical structure for the six SDMS indicators.

Table 6. Estimates of the first-order factor loadings and their standard errors (in parentheses) obtained in the validation sample (n = 401)

Item	First-order Factor					
	F1		F2		F3	
Mo3	.802*	(.030)				
Mo4	.894*	(.026)				
Mo7			.926*	(.023)		
Mo8			.922*	(.019)		
Mo9					.815*	(.033)
Mo10					.860*	(.032)

* p < .001

Measurement Reliability of the SDMS

The measurement reliability of the SDMS was assessed with model-based reliability estimation (Zinbard, Revelle, Yovel, & Li, 2005) for ordinal indicators (Gaderman, Guhn, & Zumbo, 2012). A stratified omegaH = .92 was obtained for the general SDMS factor. The following coefficients omega were obtained for the three subscale factors: .84, .92, and .83, which indicated the relatively good measurement reliability of the scale.

Table 5. Self-Diagnostic Motive Scale (SDMS)

Sequence of models tested and model fit indices obtained in the calibration and validation samples

Model	Calibration Sample (n = 553)						Validation Sample (n = 401)					
	X^2	df	ΔX^2	Δdf	RMSEA	CFI	X^2	df	ΔX^2	Δdf	RMSEA	CFI
M0	829.41**	32	-----	-----	.211	.963						
M1	12.90*	6	-----	-----	.046	1.00	27.94**	6	-----	-----	.095	.993
M2	10.38	8	2.33	2	.023	1.00	16.01*	8	1.24	2	.050	.998
M3	774.18**	9	-----	-----	.393	.965	385.56**	9	-----	-----	.323	.887

* p < .05; ** p < .001

Discussion

The hypothesis stated a three-factor solution: self--knowledge motive; self-improvement motive; self--enhancement motive. We did obtain a three-factor solution; however, the items configured into a different design than was anticipated. We tried to establish the most adjusted denouement. Based on fundaments of self-assessment motive in face of looking for information about self (Trope, Pomerantz, 1988) we examined motivational clues concerning self-diagnostics with factors: looking for one's own good and bad effects of solving the task (to establish the best way to be effective); questing self-improvement information (to be better in the future); searching for diagnostic information about the self by comparing one's own task results to those of others. The three factors merged into one factor that we called the self-diagnostic motive. The logic of the statistical approach revealed information that really mattered to the performer in the face of the task solving process. According to our thesis, the self-improvement motive (F2) appeared to be precisely consistent with our predicted items. However, self-enhancement did not occur at all. Self-knowledge was divided into two factors: one (F1) is connected with the personal meaning of the effects of solving the task, while the other (F3) is related to social background (how my results compare with those of the others in the group).

Thus, we designated three self-motives factors: F1 – looking for one's own good and bad effects of solving the task (own results information ORI); F2 – questing self--improvement information (self-improvement information SII); F3 – searching for diagnostic information about the self by comparing one's own results to those of others (comparison information CI). In fact, the three first-order factors loaded (with equal loadings) on a second-order factor that we called the self-diagnostic motive (SDM). This means that two items for each of the three motives can be summed up or averaged within each of the three motives or that the three researched motives themselves can be summed up or averaged, which includes all six items on the SDMS scale. The correlation between MCSQ-40 and SDSQ is positive, but rather weak ($r = 0.238$, $p = 0.024$). After completing our task to create a dependent measure that indicates the motivation to look for self-diagnostic information (comprising the drive for self-improvement, the need for self-assessment based on task results, and the drive for self-assessment by comparing one's own results with those of others), we turned to verifying (and to replicate study 1) whether high MCS individuals showed a stronger tendency to search for diagnostic information about themselves when feedback was negative than did their low MCS counterparts.

Study 3. MCS and motivation to search for diagnostic information about one's self

Trope and Neter (1994) showed that the intensity of self-enhancement is related to feedback on a participant's future life perspectives (positive vs. negative). However, we suspected that MCS moderates the result of Trope and Neter (1994). The outcome of study 1 showed that high MCS participants strived more for diagnostic information about themselves than did the low MCS participants. Moreover, MCS is positively correlated with positive metacognition (Konarski & Brycz, 2017), and the higher the MCS is, the more accurate the self-perception of biases is. Additionally, the positive correlation between MCS and confirmation bias is moderated by the ability to achieve cognitive structuring. The latter means that the higher MCS–higher confirmation bias relation is valid only for participants who are characterized by a low ability to achieve cognitive structuring, or, in other words, by people who use piecemeal processing (Bar-Tal, Brycz, Dolinska, & Dolinski, 2017). Thus, we suspect that negative feedback could serve high MCS participants as a motive to search for self-diagnostic and self-improvement information in contrast to low MCS people. We also would like to point out once more that MCS predicts self-accuracy, which means that the higher MCS is, the more the biases inherent in the questionnaire are expressed in behavior (Brycz, Wyszomirska-Góra, Bar-Tal, & Wisniewski, 2016).

We hypothesized that the higher MCS is the greater the need is to seek diagnostic information about self especially when feedback is negative.

Participants

Ninety full-time undergraduate students participated in the study: 47 of them were recruited randomly at the University of Gdansk (24 females, 23 males) and 43 at the Gdansk University of Technology (21 females, 22 males), aged: $M = 22.45$, $SD = 1.57$. Individuals were randomly assigned to be exposed to different experimental conditions.

Procedure

The students were informed of the scientific goal of the study and were assured that their anonymity would be protected. They were also informed that there would be no compensation for participation in the study. Analogous rooms were booked at the respective university campuses. The participants who consented took part in a single study session. Initially, they were asked to complete the MCSQ-40 (Brycz & Karasiewicz, 2011) as a supplemental task that was not connected with the whole study test. Next, the participants were asked to complete another questionnaire (Eysenck EPI Questionnaire, 1965). This particular test was to show their life perspectives and future achievement level. The students were told that the results would be provided immediately after the session (the researcher calculated the results on the spot). The participants were randomly subjected to one of three feedback conditions: negative feedback (the questionnaire asserted negatively about their life perspectives and future achievements), positive feedback (the questionnaire asserted positively about their life perspectives and future achievements), and no feedback (it was not possible to calculate the results at the time). The subjects were also told that it might be possible to obtain further information about their results. They were asked to what extent they would

want to know more about themselves. Then the researcher handed out the SDMS (dependent variables) and all of the participants filled completed this questionnaire.

At the end of the experiment all of the subjects were thanked and fully debriefed. The students from the negative feedback group were offered a candy bar. All of them accepted the small snack.

The pattern of the experiment was as follows: MCS x three feedback – independent variables for three self-diagnostic motives, and the overall SDM (dependent variable). Motives were calculated as a mean of two items per motive, and the mean of six items for the SDM.

Results

Linear regression analysis was performed for each experimental group with metacognitive self (MCS) as the independent measure for each dependent measure: ORI; SII; CI; SDM (Tables 7, 8, 9). The analysis revealed

Table 7. The role of MCS and feedback in seeking self-diagnostic information

Feedback	Seeking information	R^2	β	t	Significance
Positive	ORI	.042	-.048	-.257	n.s.
	SII	.001	.206	1.113	n.s.
	CI	.002	-.021	-.112	n.s.
	SDM	.002	.043	.229	n.s.
Negative	ORI	.050	.217’	1.176	0.12
	SII	.154	.392**	2.254	0.01
	CI	.067	.258’	1.413	0.08
	SDM	.113	.336*	1.885	0.03
Control Group	ORI	.047	-.159	-.853	n.s.
	SII	.011	.107	.569	n.s.
	CI	.001	.035	.186	n.s.
	SDM	.001	-.001	-.007	n.s.

* p = 0.05; ** p = 0.01

Note. ORI = own result information; SII = self-improvement information; CI = comparison of self to other information; SDM = overall self-diagnostic motive

Table 8. Correlation among variables only for the negative feedback group

	1	2	3	4	5
MCS (1)	x				
ORI (2)	.217	X			
SII (3)	.402**	.707***	x		
CI (4)	.258	.600***	.550***	x	
SDM (5)	.336*	.755***	.855***	.876***	x

Table 9. Correlations among all variables

Variables	1	2	3	4	5	6
Group (1)	x					
MCS (2)	0.068	X				
Comparison (3)	0.116	0.089	x			
Info-task (4)	-0.024	0.15	0.449**	x		
Self-improvement (5)	0.060	0.315**	0.464**	0.443**	x	
Overall-self-diagnostic (6)	0.067	0.172	0.820**	0.781**	0.788**	X

p < 0.01

that MCS had no significant effects on the dependent measures in the positive feedback or control groups. However, among participants from the negative feedback group MCS was found to have a significant effect on SII (seeking self-improvement information) and on SDM (the overall self-diagnostic motive). ORI, which was looking for one's own tasks results, and CI, which was comparing information on how the results of others differ from one's own results were almost significant.

Discussion

The results seem plausible. Generally, people are interested in their outcome in comparison to others in a group, and in comparison to the correctness of results before making decisions (Gollwitzer & Kinney, 1989). Only participants high in MCS, in contrast to low MCS subjects, sought more information in order to change their behavior and fulfill the self-improvement motive, when feedback was negative. Moreover, participants with a higher metacognitive self strived for self-diagnostic information more often since their motivation to obtain self-diagnostic data is stronger than that among low metacognitive self counterparts.

General discussion

In general, while searching for information concerning themselves people prefer to receive information which is positive. The results of the first study (study 1) show that the motive of self-knowledge occurred in the experimental group, because the self-assessment of one's results had a significant effect on the willingness to obtain feedback. In our study we managed to show that high metacognitive self individuals are more interested in diagnostic information about themselves than are low metacognitive self individuals. The former group wanted to receive information concerning their test results when they knew they were compared with other students' results on a national scale significantly more often than did low metacognitive self individuals. This effect was not repeated in the control group where the test results were said only to verify the credibility of the new questionnaire. This indicates that high metacognitive self individuals are more motivated to collect information about themselves, which is, first of all, diagnostic, and therefore, allows them to get to know themselves better in certain fields.

The second study (study 2) was necessary to provide a scale for measuring self-diagnostic motives. We used this scale during the third study, as the dependent measure.

While the first study shows the need for diagnostic feedback among high MCS participants, the third study (study 3) proved that high MCS individuals are motivated to obtain self-diagnostic and self-improvement information only when feedback is negative. The results show that high MCS serves regulatory functions. Self-awareness of biases probably provokes alertness when the ego is threatened. The alertness instead of the arousing motive to calm down and boost the ego fosters gaining relevant, diagnostic information about the self. The very information is necessary for self-improvement. Participants in the third study did not differ in their need for all motives, regardless of MCS, when feedback was positive or there was no feedback. Only high MCS were able to overcome the threat and look for self-regulatory information (self-improvement and self-diagnostic).

The piecemeal processing toward the self that characterizes high MCS individuals facilitates better cognitive and motivational adjustment in difficult situations.

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Appendix

SDMS

You will find six questions or statements that describe your interest in the results of the tack you just completed. Please answer "how much you want to know about yourself based on the results of the task" from 1 – "I definitely don't want to know anything about it" to 6 – "I definitely want to know about it."

1. I definitely don't want to know anything about it
2. I don't want to know about it
3. I don't really want to know
4. I want to know about it
5. I really want to know about it
6. I definitely want to know everything about it

FACTORS	ITEM	PARTICIPANT EVALUATIONS
F1 Looking for one's own good and bad effects of solving the task	What negative things does the test say about me?	1 2 3 4 5 6
	What positive things does the test say about me?	1 2 3 4 5 6
F2 Questing self-improvement information	What can I do to make myself better off in my life achievements?	1 2 3 4 5 6
	How can I change my behavior to improve my life achievements?	1 2 3 4 5 6
F3 Searching for diagnostic information about the self by comparing one's own results to those of others	To what extent did I complete the task worse than others?	1 2 3 4 5 6
	To what extent did I complete the task better than others?	1 2 3 4 5 6