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TEMPERAMENTAL BASIS OF A BALANCED TEMPORAL PERSPECTIVE: THE MEDIATING ROLE OF TEMPORAL METACOGNITION

Abstract: Scientific studies carried out in the field of temporal psychology provide a growing number of data suggesting a key role of a balanced temporal perspective in social and emotional adaptation. The current study attempted to empirically replicate results suggesting a key role of temperamental characteristics in the development of temporal balance. The novel character of performed analysis took into account a new construct from within the scope of individual differences – dimensions of temporal metacognition. The study employed 115 participants. They filled in the personality questionnaire FCZ-KT, Zimbardo Time Perspective Inventory, which measures individual differences in temporal perspectives and a temporal metacognition scale (TMCS). The analysis point to a significant role of temperamental traits – emotional reactivity and briskness – in the development of temporal balance. Moreover, it was shown

that the relationship between temperament and balanced temporal perspective is fully mediated by the dimensions of temporal metacognition – metacognitive temporal control and goal-oriented temporal interconnectedness. Importantly, the first of these dimensions turned out to be conditioned by the temperament to a far larger degree than the second one (42% vs. 4% of the mediated variability). The result allows a conclusion of a different basis of the two aspects of metacognition: temperamental – in the case of control, and non-temperamental (cognitive or experience-based) – in the case of continuity. Temporal metacognition can, therefore, be a mechanism responsible for relationships between temperament and balanced temporal perspective described in the field literature.

Keywords: temperament, temporal perspective, balanced temporal perspective, temporal metacognition.

INTRODUCTION

Philip G. Zimbardo and John Boyd (1999, 2008) describe *time perspective* (TP) as one of the most important factors that influence evaluative processes, determine the quality and intensity of emotional experience, and as a result, shape the individual's behavior. Previous studies following the paradigm proposed by the American researchers prove that, indeed, TP can be treated as a regulatory feature of considerable importance e.g. for the experience of emotions and mood (Stolarski et al., 2014), health (Daugherty, Brase, 2010), cognitive efficiency (Zajenkowski et al., 2016a) and general

well-being (Zhang, Howell, Stolarski, 2013). At the same time, classical approach to this issue particularly emphasize the motivational role of the future time perspective (e.g. Simons et al., 2004).

The construct of a time perspective (*balanced TP*; BTP; Zimbardo, Boyd, 1999) plays a crucial role for the TP concept. It is defined as an ability to effectively switch between particular time perspectives, which enables effective adaptation to the current situation (see: Stolarski, Wiberg, Osin, 2015). Zimbardo and Boyd (2008) claim that it is the temporal flexibility that allows for effective use of possibilities resulting from the unique human ability to experience *mental time travel* (Suddendorf, Corballis, 2007).

Numerous empirical studies seem to confirm this thesis. For example, it was shown that individuals manifesting the balanced profile of time perspectives are characterised by more adaptive mood profile (Stolarski et al., 2014), lower stress and anxiety (Papastamatelou et al., 2015) as well as lower intensity of post-traumatic stress disorder resulting from the exposure to trauma (Stolarski, Cyniak-Cieciura, 2016). When performing some cognitively demanding tasks, such individuals experience higher task engagement, lower worry and distress, which results in significantly better performance (Zajenkowski et al., 2016a). They are also characterised by a more adaptive perception of time, which makes them experience it as passing slower, they feel less time pressure and get bored less frequently than individuals of lower temporal balance (Wittmann et al., 2015). They are also more satisfied with their romantic relationships (Stolarski, Wojtkowska, Kwiecińska, 2016), they spend their free time in a healthier way (Garcia, Ruiz, 2015) and their business decisions are more ethical (Unger, Yan, Busch, in press).

In the light of the aforementioned results it is of major importance to answer the question on the determinants of the temporal balance. In this study, we analyzed the relationships between balanced temporal perspective and the two groups of individual characteristics: 1) temperamental traits distinguished within the Regulative Theory of Temperament (RTT; Strelau, 2006; Strelau, Zawadzki, 1993) and 2) dimensions of temporal metacognition proposed by Maciej Stolarski and Joanna Witkowska (2017). On the basis of the theoretical analysis it was assumed that both groups of variables might play an important role in the development of the balanced TP profile.

TIME PERSPECTIVE THEORY

Zimbardo and Boyd (1999) defined TP as a process in which constantly acquired personal and social experiences are attributed to particular categories – time perspectives; these categories give life events coherence and meaning and they arrange them. At the same time, the process, just as its impact on behavior, remains beyond consciousness, which has been described by the American researchers as time paradox (Zimbardo, Boyd, 2008).

The abovementioned definition is slightly elusive and unclear, particularly considering the discrepancy between the postulated processual character of the TP and the measurement method used in the majority of studies, which operationalize the phenomenon in the categories typical for psychology of individual differences – as a set of relatively stable dispositions. Having recognized the discrepancy, Maciej Stolarski, Nicolas Fieulaine and Philip G. Zimbardo (2018) reconceptualized the TP, offering new definitions and describing in detail the relationships between the momentary fo-

cus on a specific time frame and individual habitual dispositions to remain focused on a particular time horizon.

The authors underline that when processing the information about the surrounding reality, people constantly and usually entirely automatically allocate their cognitive resources between memories (the past), plans and possible scenarios (the future) and current events (the present). They describe the momentary focus on one of the time perspectives as *state-TP*. As a result of inborn temperamental mechanisms, and particularly, as a result of life events (the influence of family, education, culture, traumas etc.), an individual might develop a habitual tendency to focus on one or a few time horizons and ignore the others (see: Zimbardo, Boyd, 2008). This process describes the development of *trait-TPs* (Stolarski, Fieulaine, Zimbardo, 2018) – relatively stable differential characteristics, which, additionally, include the attitude component (e.g. *Positive-Past*). Zimbardo and Boyd (1999) distinguished five fundamental TP dimensions, which have been supplemented with some others over the last 20 years. The tool used in this study measures six TP dimensions: Past-Negative, Past-Positive, Present-Hedonistic, Present-Fatalistic, Future-Positive and Future-Negative. Additionally, one of the main concepts in the TP universe is the previously mentioned balanced temporal perspective.

BALANCED TEMPORAL PERSPECTIVE

As previously mentioned, the crucial importance of BTP lies in the effectiveness of “switching” between different time frames. Nevertheless, the ability to refrain from concentrating on the undesired temporal aspects of the current situation (e.g. pondering on the previous failures when it would be most adaptive to focus on the future goals and plans) seems equally relevant. These were Marcin Zajenkowski et al. (2016b) who evidenced that BTP is significantly related to the effectiveness of the executive functions – in their study represented by *inhibition*. Discussing the results, the authors underlined that it is the effective use of inhibition and switching that enables the development of the temporal balance. Basing on the results of Zajenkowski et al. (2016a, 2016b), Stolarski and Witowska (2017) proposed a new approach, referring BTP to the construct well-known to researchers studying cognitive processes – namely: metacognition.

TEMPORAL METACOGNITION

Temporal metacognition is a new individual difference feature that derives from the TP theory (Stolarski, Witowska, 2017). This concept is particularly related to the idea of BTP, but also to classical approaches to metacognition (Flavell, 1979; Efklides, 2008) – the phenomenon of “thinking about thinking”. Metacognition is also defined as monitoring and controlling one’s own cognitive processes and also as being aware of one’s own mental states and inner reality (Nelson, 1992), and its main goal is usually to optimize the effectiveness of one’s own cognitive processes. John Flavell (1979) distinguishes three basic aspects of metacognition: metacognitive knowledge, strategies and experiences. Stolarski and Witowska (2017) notice that the essence of BTP – the transition from “usually nonconscious” (Zimbardo, Boyd, 1999) TP to at least

partially conscious and intentional switching between the time frames – is a metacognitive process related to becoming aware, as well as to monitoring, gathering knowledge and experience and conscious self-regulation in terms of concentrating on particular time frames.

Therefore, temporal metacognition refers directly to conscious focusing one's attention on the particular time frame (i.e., *managing temporal focus*). It is the effective allocation of attention between particular temporal perspectives that is the basis for the BTP development, at least considering its definition. Similarly to the construct of TP, also in the case of BTP there occurs a discrepancy between the definition and the empirical operationalization. BTP is defined as a kind of “temporal flexibility” (see: Zimbardo, Boyd, 1999), whereas its empirical operationalizations (see: Boniwell et al., 2010; Stolarski, Bitner, Zimbardo, 2011) focus on matching the individual profile of temporal perspectives to the specific, particularly adaptive set of temporal perspectives (high Positive-Past, increased level of Future and Present-Hedonistic, low Negative-Past and Present-Fatalistic; see: Zimbardo, Boyd, 2008). Although the empirical data confirm the adequacy of studying BTP using profile approach (see: Stolarski, Wiberg, Osin, 2015), the possibility to understand the essence of temporal balance using such methodology is limited.

Stolarski and Witowska (2017) based their conceptual and empirical studies on the aforementioned definition considering BTP as the ability to effectively switch between the perspectives depending on the situation, task demands or personal resources (Boniwell, Zimbardo, 2004). Such a definition implies understanding BTP as a type of skills related to the ability of switching between the temporal frames. Thus, the concept of temporal metacognition assumes that the development of BTP requires the awareness of the currently “active” TP as well as cognitive resources enabling to intentionally control the automatic tendencies to focus on particular temporal perspectives.

Therefore, temporal metacognition is defined as the awareness of “active” TP and intentional regulation of one's own temporal frames. Such a regulation is possible due to metacognitive knowledge, general temporal skills and experiences (Stolarski, Witowska, 2017). Using empirical analyses (including exploratory factor analysis of items generated on the basis of TP and metacognition theories), Stolarski and Witowska (2017) distinguished three basic dimensions of temporal metacognition:

- 1) Metacognitive Temporal Control – the ability to control and inhibit concentration on the temporal frame that is either maladaptive, hinders the possibility to engage in the currently performed activities or “blocks” another temporal frame that would be more desired in this particular situation;
- 2) Cognitive Reconstruction of the Past – the ability to reconstruct and reinterpret the past events in relation to present experiences; the ability to maintain “open past”, being the readiness to change the perspective of perceiving the past and its interpretation;
- 3) Goal-oriented Temporal Interconnectedness – the ability to cognitively combine (synthesize) the temporal frames and integrate information and motivation provided by each of these in order to achieve goals more effectively and enhance the accuracy of decision-making.

Temporal metacognition is a new construct in temporal psychology, thus, the knowledge on the character of the dimensions proposed by Stolarski and Witowska (2017) is limited to their validation research results. The data show that particular as-

pects of temporal metacognition are significant predictors of BTP, which provides the basic proof of the validity of the news scales and seems to confirm that metacognitive processes constitute one of the basic mechanisms underlying the principles of temporal balance. Additionally, positive relationships with satisfaction with life and strategic flexibility described by Cantwell (Stolarski, Witowska, 2017) also prove the adaptive character of the temporal metacognition dimensions. The research described by Stolarski and Witowska was for exploration and/or validation purposes, therefore, this justifies the need to replicate them and expanding the research with new research issues allowing for more detailed description and understanding of the temporal metacognition and balanced TP.

Importantly, although both these phenomena are of cognitive nature, to a large extent they might be determined by particular temperamental traits. Błażej Szymura (2007) as well as Maria Ledzińska, Maciej Zajenkowski and Maciej Stolarski (2013) provided abundant evidence on the importance of temperament in the effectiveness of cognitive processes, including inhibition and attentional switching. Especially the latter results seem crucial considering the perspective adopted in the presented analyses. Ledzińska et al. based their study on the regulative theory of temperament, which, due to the traits that it contains, constitute a particularly valuable point of reference for personality and cognition research.

REGULATIVE THEORY OF TEMPERAMENT

Jan Strelau (1993, p. 117) defines temperament as a set of “basic, relatively stable personality traits which apply mainly to the formal aspects of reactions and behavior (energetic and temporal characteristics)”. The features related to the energetic level of behavior include:

- emotional reactivity, being the “tendency to react intensively to emotion-generating stimuli, expressed in high emotional sensitivity and in low emotional endurance” (Strelau, Zawadzki, 1993, p. 327);
- sensory sensitivity, i.e. “ability to react to sensory stimuli of low stimulative value” (Strelau, Zawadzki, 1993, p. 327);
- endurance – the “ability to react adequately in situations demanding long-lasting or high stimulative activity and under intensive external stimulation” (Strelau, Zawadzki, 1993, p. 327);
- activity – i.e. “tendency to undertake behaviour of high stimulative value or to supply by means of behaviour strong stimulation from the surroundings” (Strelau, Zawadzki, 1993, p. 327).

Temporal parameters include briskness, being the “tendency to react quickly, to keep a high tempo of performing activities, and to shift easily in response to changes in the surroundings from one behaviour (reaction) to another” (Strelau, Zawadzki, 1993, p. 327) and perseverance – “tendency to continue and to repeat behaviour after cessation of stimuli (situations) evoking this behaviour” (Strelau, Zawadzki, 1993, p. 327). It is worth mentioning that the authors added the dimension of rhythmicity to the recent, revised version of the FCZ-KT(R) questionnaire (see. Cyniak-Cieciura, Zawadzki, Strelau, 2017), yet, considering that the presented empirical study based on the previous version of the questionnaire, this dimension will not be discussed here.

TEMPERAMENT, COGNITIVE FUNCTIONING AND TEMPORAL PERSPECTIVES

The first assumption of RTT seems particularly important: temperament manifests itself in the formal characteristics of behavior” (e.g. Strelau, 2006). In other words, temperamental traits influence the behavior of an individual irrespective of the content of behavior or life domain in which the activity is undertaken. Ledzińska et al. (2013) emphasize that cognitive processes are one of the most important aspects of human’s behaviors, thus, it might be assumed that the impact of temperament will be observable also in the context of cognitive activities. Their research confirmed the relationship between temperamental traits and the performance in intelligence tests and tasks engaging attention and working memory or various aspects of metacognition. Due to the abundance and complexity of previous results on that issue it is not possible to analyze them in detail here, yet, it is worth mentioning the negative relationships between emotional reactivity and the effectiveness of alternating/dividing attention as well as negative relationships between the number of mistakes made when performing attention-engaging tasks and the intensity of briskness and sensory sensitivity (Ledzińska, Zajenkowski, Stolarski, 2013). Temperament might also influence individual differences as regards TP, which was proved by studies involving general population (Ledzińska, Zajenkowski, Stolarski, 2013) as well as clinical samples (Stolarski, Cyniak-Cieciura, 2016).

Temperamental regulation of arousal is largely an automatic process – consciousness and intentionality of behavior refer mainly to the content of behavior, not to its form. At the same time, the particular level of traits included in the RTT model might be perceived as a “resource” that might enhance intentional activity. The authors of this concept emphasize that some of the proposed dimensions might be considered indices of the ability to process stimulation (see: Zawadzki, Strelau, 1997). Thus, to some extent, temperamental traits determine not only the course of behavior (influencing its tempo, intensity etc., see: Strelau, 2006), but they also affect the effectiveness of these processes (e.g. higher briskness impacts the speed of performing cognitive tasks and indirectly, also their effectiveness; see: Ledzińska, Zajenkowski, Stolarski, 2013). In the presented study, the processes that might be influenced by temperament included plasticity and inhibition related to the focus on particular time frames – the processes that represent the essence of temporal metacognition and thus, constitute a kind of “gate” to temporal balance.

Maciej Stolarski and Maria Cyniak-Cieciura (2016) were the first to analyze the relationships between temperament and BTP empirically. In their study, the temporal balance related significantly to five temperamental traits, three of which (emotional reactivity, briskness and sensory sensitivity) were its significant predictors in a regression model, explaining 22% of variation of BTP. Even though those results shall not be generalised (the study included the sample of motor vehicle accidents survivors), they might serve as a point of reference for the studies involving general populations.

RESEARCH OBJECTIVE AND HYPOTHESES

The paper presents the results of the replication of the abovementioned studies, including the population of healthy individuals. The study also included the dimensions

of the temporal metacognition that, following the theoretical assumptions (Stolarski, Witowska, 2017), are the basis of the BTP.

First, similarly to Stolarski and Witowska (2017), we assumed (H1) that the temporal metacognition dimensions will be significant predictors of BTP. Such hypothesis derives from the concept of BTP (Zimbardo, Boyd, 1999) and the theoretical assumptions of the temporal metacognition theory. The confirmation of this hypothesis would also constitute confirm the results achieved by Stolarski and Witowska (2017) who showed that three dimensions of temporal metacognition are significant predictors of BTP and explain over 35% of temporal balance variation in total.

Second, it was expected that temperamental traits proposed within RTT (Strelau, 2006; Zawadzki, Strelau, 1997) will be significant predictors of temporal metacognition dimensions (H2) as well as the balanced temporal perspective itself (H3). In particular, specific assumptions were made about the three dimensions of temperament that occurred significant predictors of BTP in the study by Stolarski and Cyniak-Cieciura (2017). Briskness, in accordance with the previously-mentioned definition, includes the component of plasticity, thus, it should facilitate dynamic switching between particular temporal perspectives in response to the demands of the situation. Emotional reactivity might promote impulsive changes in TP-state, decreasing the possibility to control which temporal frame remains “active” in the particular moment. In other words, high-reactive individuals might be characterised with increased external control over that activation of temporal frames. Moreover, increased negative emotionality might reinforce the tendency to focus on non-adaptive perspectives (i.e., past-negative and present-fatalistic), which indirectly leads to unbalanced TP profile. Sensory sensitivity, in turn, being the temperamental basis for attentional alertness (Ledzińska, Zajenkowski, Stolarski, 2013) and, by its nature, promoting awareness (see: Zawadzki, Strelau, 1997), might enhance the effective direction of attention to particular temporal frames, adequately to the changing situational context. The relationships seem probable, considering the previously reported associations between mindfulness and temporal balance (Stolarski et al., 2016b). The expectation of the occurrence of relationships between temperament and temporal metacognition is also justified by the results achieved by Małgorzata Dragan et al. (2012) who confirmed numerous associations between temperamental traits and the intensity of dysfunctional metacognitive beliefs.

The last hypothesis refers to the triad of relationships including temperament-metacognition-BTP. In the light of the above theoretical reflections, it is reasonable to assume (H4) that temporal metacognition serves as a mediating mechanism (i.e., a mediator) in the relationship between temperament and temporal balance.

METHODS

Study procedure and participants

The study included 115 participants (59 males, 56 females) aged 18–35, living in Warsaw and Kielce. The participants were recruited with the use of social media, yet, the paper-and-pencil measurement was conducted in the presence of an interviewer. The participants filled in a survey on their gender and age. Each person was asked to fill in three questionnaires in the following order: 1) Formal Characteristic of Behavior – Tempera-

ment Questionnaire (Zawadzki, Strelau, 1997), 2) Temporal Metacognition Scale (Stolarski, Witowska, 2017) and 3) Time Perspective Inventory (Zimbardo, Boyd, 1999).

Measurement methods

Temperament was measured with the use of the Formal Characteristics of Behavior – Temperament Questionnaire (Zawadzki, Strelau, 1997). The tool reflects the thesis of the Strelau's RTT (2006). It consists of six scales corresponding with the temperament dimensions described earlier. The validity and reliability of the tool are satisfactory.

Temporal perspectives were measured using the Polish adaptation (Kozak, Mażewski, 2007) of the Zimbardo Time Perspective Inventory (ZTPI; Zimbardo, Boyd, 1999). The study used a modified version of the tool, supplemented with the additional Future-Negative dimension (Carelli, Wiberg, Wiberg, 2011). It was decided to use the six-factor model because in the Polish population it fit the data better as compared to a five-factor model (Jochemczyk et al., 2017).

Balanced time perspective was estimated using the indicator *Deviation from the Balanced Time Perspective* (DBTP; Stolarski et al., 2011). The indicator is calculated based on the results of the ZTPI questionnaire. The research comparing its validity with other measures of temporal balance showed considerable advantage of DBTP (Zhang, Howell, Stolarski, 2013).

Temporal metacognition was measured using the Polish version of the Temporal Metacognition Scale (TMCS; Stolarski, Witowska, 2017). The questionnaire includes three scales corresponding to the three previously-mentioned aspects of temporal metacognition. The scales demonstrate high reliability (Cronbach's alpha ranging 0.78–0.88), and their validity was demonstrated both in relation to other aspects of metacognition, as well as to measures of well-being or TP dimensions.

RESULTS

Table 1 presents descriptive statistics and inter-correlations between the variables.

The results of the correlation analyzes allow to draw preliminary conclusions. First, the relationships showed by Stolarski and Witowska (2017) were confirmed, which indicated, as expected basing on the theoretical assumptions, the associations between the temporal metacognition dimensions and the temporal balance. Yet, in the case of the cognitive reconstruction scale the relationship was at the level of statistical tendency towards significance $r = -0.18$, $p = 0.06$. It is worth noting, however, that all the three indicators were lower than in the case of the validation study (-0.31 , -0.18 and -0.37 in comparison to -0.54 , -0.24 and -0.42). Negative correlations between temporal metacognition scales and the DBTP indicate significant positive relationships between the increase in abilities and adaptive metacognitive beliefs and the level of the temporal balance.

In this sample, the dimensions of the temporal metacognition were significantly correlated. Thus, to identify the dimensions of temporal metacognition that are crucial for prediction of temporal balance a regression analysis was carried out, using DBTP indicator as a dependent variable and TMCS scales as predictors. The backward elim-

ination method was used, which allowed for the automatic elimination of irrelevant predictors and obtaining a model with the highest possible predictive value. The final model was significant, $F(2,112) = 10.789, p < 0.001$, and it contained two predictors: metacognitive control, $\beta = -0.19, p = 0.05$, and intertemporal continuity, $\beta = -0.29, p < 0.001$, in total explaining 16.2% of the variance of the dependent variable.

Next, it is worth noticing the temperamental correlates of the temporal balance. Two out of six scales of the FCZ-KT, briskness and emotional reactivity, were found to be significantly related to the BTP: highly reactive people were characterized by a greater deviation from the balanced time perspective, whereas individuals with high briskness were characterized by more balanced TP.

Further, temperamental correlates of temporal metacognitive dimensions were analyzed. According to the posed hypotheses, it was expected that these groups of variables are significantly related, whereas the adaptive profile of temperament is characteristic for individuals who obtain high scores in TMCS scales. Metacognitive Control proves to be significantly related to all dimensions of temporal metacognition except sensory sensitivity, and the strongest relationships were observed for the emotional reactivity ($r = 0.62, p < 0.001$). Intertemporal continuity was related with temperament to a lesser extent – reactivity was the only significant correlate, $r = -0.21, p = 0.03$, the relationships with briskness and endurance were on the verge of significance (in both cases $r = 0.18, p = 0.05$). Cognitive reconstruction of the past has not turned out to be significantly related to any temperamental trait.

To identify the significant temperamental predictors of metacognitive control and continuity, regression analysis using the backward elimination method was performed again. In the case of metacognitive temporal control, the final model, $F(3,111) = 28.359, p < 0.001$, contained three significant predictors: emotional reactivity, $\beta = -0.53$,

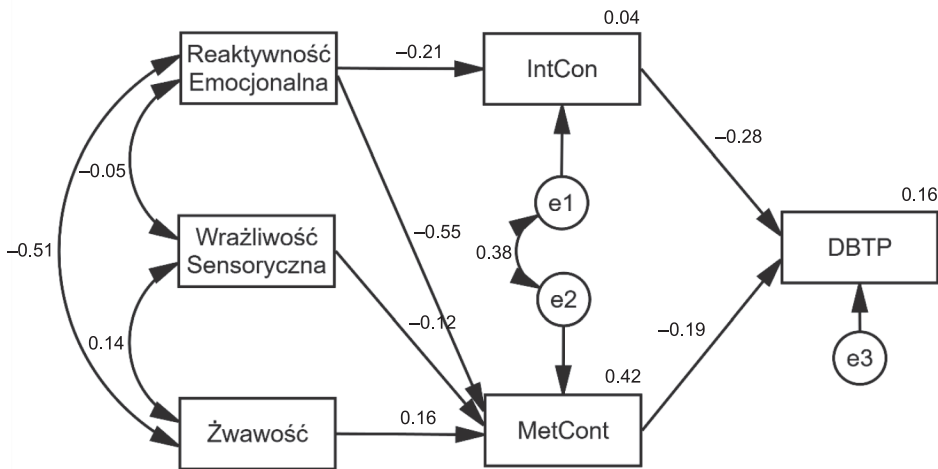


FIGURE 1. Path model depicting the relationships between temperamental traits, temporal metacognition dimensions and the indicator of the deviation from the balanced time perspective $\chi^2 = 3.095, df = 5, p = 0.685, \chi^2/df = 0.619, GFI = 0.991, CFI = 1.000, RMSEA = 0.000$ (rounded values). The values above the rectangles with the dependent variables indicate the percentage of variance explained by the predictors included in the model. IntCon = Goal-oriented Temporal Interconnectedness; MetCont = Metacognitive Temporal Control

$p < 0.001$, briskness, $\beta = 0.19$, $p = 0.02$, and sensory sensitivity, $\beta = -0.16$, $p = 0.03$, explaining in total 43.4% of the variance of the dependent variable. In the case of the intertemporal continuity dimension, the final model, $F(1,113) = 5.096$, $p = 0.03$, contained only one significant predictor – emotional reactivity, $\beta = -0.21$, $p < 0.001$, and it explained 4.3% of the variance of the dependent variable. Due to the lack of significant correlates, no analogous analysis was carried out for the dimension of the cognitive reconstruction of the past.

Based on the performed analysis, an attempt was made to construct a path model depicting the temperamental base of BTP and including the mediating role of temporal metacognition, which was analyzed using SPSS Amos 24. The model included three temperamental predictors (emotional reactivity, briskness and sensory sensitivity) and two dimensions of temporal metacognition (metacognitive temporal control and intertemporal goal-oriented continuity), as well as the DBTP indicator, which was a dependent variable. The model, shown in Figure 1, was perfectly fit to data $\chi^2 = 3.095$, $df = 5$, $p = 0.685$, $\chi^2/df = 0.619$, $GFI = 0.991$, $CFI = 1.000$, $RMSEA = 0.000$ (rounded values). The analysis of modification indices did not show potential additional paths that would improve the goodness of fit of the model, which means that the effect of temperament on the balance indicator turned out to be fully mediated by the dimensions of temporal metacognition.

DISCUSSION

The present paper shows the empirical analysis of the relationships between the temperament dimensions and indices of temporal self-regulation (temporal metacognition) and temporal adaptation (BTP). The obtained results seem to essentially confirm the role of temporal metacognition in the development of the balanced TP (H1), but the strength of the observed associations was significantly lower than in the validation studies (Stolarski, Witowska, 2017) (16% vs. 35% of the explained BTP variance). Nevertheless, it can be stated that the effective control over the adopted time perspectives and high plasticity in switching between particular temporal frames horizons constitute a cognitive basis for the development of the balanced TP profile.

The relationships between the dimensions of temperament – briskness and emotional reactivity and the temporal balance assumed in the third hypothesis (H3) were also confirmed. Such a result is consistent with the associations shown by the study of Stolarski and Cyniak-Cieciura (2016) including the sample of motor vehicle accident survivors, yet, the analogous relationships in their study were significantly higher (-0.41 and 0.30 as contrasted with -0.18 and 0.19 in this study). Moreover, in the work of Stolarski and Cyniak-Cieciura sensory sensitivity was also a significant predictor, whereas it was not directly related to the balanced temporal perspective in this study.

The second hypothesis (H2) was fully confirmed only in the case of metacognitive temporal control. This dimension turned out to be associated with all dimensions of temperament except perseverance. Three traits – emotional reactivity, briskness and sensory sensitivity occurred significant predictors in the regression model, explaining a total of as much as 42% of the variance. Importantly, these were exactly the same dimensions that were predictors of BTP in the study conducted by Stolarski and Cyniak-Cieciura (2016). Low emotional reactivity occurred the most important factor for the effective temporal control. This dimension was also a predictor of tem-

poral interconnectedness – it was the only significant predictor and it explained only 4% of variance. Cognitive reconstruction of the past was not associated with temperamental traits.

Thus, it appears that one of the aspects differentiating the dimensions of temporal metacognition is the level of their load with the temperamental factor. Whilst metacognitive control seems to have a clear temperamental basis, other dimensions of metacognition seem almost independent from the basic, mainly biologically-determined (Strelau, 2006) personality traits. Therefore, it seems reasonable to assume that this is the ability to perceive the associations between time frames as well as using them to achieve goals can be shaped by experience – perhaps also through intentional developmental or therapeutic actions (Boniwell, Osin, Sircova, 2014, Zimbardo, Sword, Sword, 2012).

The analysis of structural equation modeling showed that two dimensions of temporal metacognition – metacognitive control and continuity – mediate between the temperament traits and the balanced TP profile. This result confirms the assumption formulated in the fourth hypothesis (H4) stating that the adaptive profile of temperamental traits can support the processes of metacognitive temporal regulation, indirectly contributing to the development of the balanced TP profile.

SUMMARY, LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

According to Ledzińska et al. (2013), temperament may constitute a kind of energetic resources of the mind. In the light of the results presented in this article, this thesis seems justified also in relation to the concept of temporal metacognition, whereas some aspects of this phenomenon (especially the dimension of control) turned out to be considerably more related to temperament than others (e.g. cognitive reconstruction of the past, which turned out to be nearly independent of temperamental traits). This diversity in load with temperamental factors reflects, to some extent, the results achieved by Ledzińska's team – in their research, particular aspects of cognitive functioning were also characterized by a specific pattern of associations with dimensions postulated within RTT by Strelau.

The study has many limitations, the most obvious of which is related to the correlational nature of the performed analysis. Any conclusions regarding the direction of the observed associations are speculative in nature and are based solely on the basic theoretical assumptions. Temperament, as largely innate and biologically-determined (Strelau, 2006; Zawadzki, Strelau, 1997), is treated as a “cause”, whereas TP, as a phenomenon mainly determined by experience (Zimbardo, Boyd, 2008), was perceived as the “effect”. Thus, to verify the postulated causal model empirically, longitudinal and/or experimental research is recommended (e.g., the impact of metacognitive training on the level of temporal balance).

The limited sample size (this increased the chances of obtaining a false positive result and thus, it requires caution when drawing conclusions from the path model showing five predictors in the study sample – $n = 115$), as well as a fairly narrow age range of the participants (only young adults) constituted further limitations of the described study. The generalizability of the obtained results is therefore limited.

It is also worth considering the strength of the observed relationships – they were weaker than the analogous associations shown in earlier studies including the same

variables (Stolarski, Cyniak-Cieciura, 2016; Stolarski, Witowska, 2017). Perhaps this was the result of the relative homogeneity of the sample and the resultant limited variance of the studied variables. Regardless of the reason, weaker relationships might have affected the results – for example, if the associations between temperament and BTP had been stronger (e.g. close to those reported by Stolarski and Cyniak-Cieciura, 2016), it would have been much harder to observe the effect of full mediation.

In future studies, it would be worth including other temperament models (e.g., dimensions proposed by Eysenck, Gray, Cloninger or Zuckerman; see. Strelau, 2014). It would also be interesting to supplement the analyzed structural model with a natural “final product” of the effective temporal regulation, i.e. well-being (see Zhang, Howell, Stolarski, 2013). The observed double mediation of the relationship between temperament and well-being (Fogle, Huebner, Laughlin, 2002) – mediated by the dimensions of temporal metacognition and resulting level of temporal balance – allows to depict the “temporal” path of the temperamental regulation of behavior.

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