# THE MEASUREMENT OF COGNITIVE STYLE REFLECTION--IMPULSIVITY IN THE ADULTHOOD – RESULTS OF OWN STUDY

## Paulina Michalska, Ludmiła Zając-Lamparska

Instytut Psychologii, Uniwersytet Kazimierza Wielkiego w Bydgoszczy
Institute of Psychology, Kazimierz Wielki University

**Summary**. Reflection-impulsivity determines the extent to which a man solving cognitive tasks is considering the accuracy of obvious answers and the cognitive speed. An indicator of reflection is a long response time and a small number of errors, and impulsivity – short response time and high number of errors. The main objective of own research was to examine whether people in early, middle and late adulthood have different reflection-impulsivity cognitive style. Own studies were attended by 180 adults. For the measurement of reflection-impulsivity one used the Matching Familiar Figures test, while the test material was pictorial. The results show that subjects in early, middle and late adulthood differ in terms of cognitive style of reflection-impulsivity as measured by the MFF test. However, we wish to emphasize the fact that this result raises our doubts. The reflection-impulsivity indicator expressed as the number of errors and response time is suitable only for young adults and older one
should seek other indicators of this variable.
**Key words**: reflection-impulsivity, cognitive styles, adulthood

## Introduction

The problem of cognitive style is the object of interest examined by many contemporary Polish researchers (e.g. Radziwiłłowicz, 2004; Borkowska, 2005; Lipowska, 2011). There are various concepts explaining the mechanisms of reflective and impulsive functioning. The most often, reflection-impulsivity are considered as significant property of information processing, the so-called cognitive rate: impulsivity is associated with response rate and committed errors, and reflection – with the slower rate of response and greater correctness of tasks solving. The literature points to the adaptive value of the reflection-impulsivity in cognitive functioning (com. Kogan, 1976). Most often it is assumed that reflective persons cope better with tasks that require analysis of the details and converging problems solving, while impulsive one – the tasks which require a global analysis and divergent problems.

---

Adres do korespondencji: Paulina Michalska, e-mail, pmichalska@ukw.edu.pl

In this context the ability to assess the reflection-impulsivity dimension during the whole human life is important. It allows to predict one's cognitive effectiveness in particular situations and adjust the demands or support to the individual style of the information processing. Moreover, although the reflection-impulsivity dimension describes cognitive functioning at every stage of human development, most of the existing research on this topic concerns children and adolescents. The knowledge about the changes in the reflection-impulsivity in adulthood needs to be completed. At the same time, it is not clear whether the methods based on the assumption of negative correlation between the speed and accuracy of responses used to measure the reflection-impulsivity are suitable for the assessment of this dimension during the whole lifecycle because of the lack of homogeneity of the age-related changes in these two parameters of cognitive tasks performance. In response to the above mentioned deficiencies, we present the results of research on the reflection-impulsivity, including the evaluation of the validity of this cognitive dimension measurement in early, middle and late adulthood.

**Reflection-impulsivity**

Dimension of cognitive style reflection-impulsivity is determined by the extent to which an individual solving cognitive tasks is considering the accuracy of the answers (among others Kogan, 1976; Messer, 1976; Nosal, 1979; Matczak, 1982a, b, 1992; Kozhevnikov, 2007). It manifests itself in situations in which a person is faced with a specific cognitive problem and must choose one of the possible solutions that compete with each other. Matczak (1992) defines reflection as the tendency to carefully analyze potential solutions in order to avoid mistake and find the most correct solution. Reflective persons are characterized by the fact that they commit fewer mistakes, postpone their statements and have a long time of response, but all in order to find the best solution. They prefer logical-verbal elements of the situation and versatility of information collection. They focus attention on the tasks better, directing it to relevant content from a particular point of view. They are also characterized by a higher level of capacity for analysis and synthesis perception. This feature is conducive to converging problems solving. Moderate reflection is associated with a high demand for stimulation. It should be emphasized that in order to determine this dimension of cognitive style, it is not enough only to have a long time of response, but the condition of correctness of task should also be met.

In contrast, impulsivity is defined as the tendency to adopt the first solution that comes to mind, without regard to its correctness (Matczak, 1992). A clear indicator of this feature is the short response time and high number of errors. Impulsivity is conducive to solving the divergent problems. Impulsive people have a high sensitivity to sensory stimuli, and their attention is more dispersed. They have a tendency to involuntary memorizing and are rather one-sided with respect to problematic situations. This feature is more beneficial in situations in which the reliability of work does not matter, and only the result of the work measured with speed. Reflection is considered to be a developmentally and cognitively more beneficial way to reduce stimulation, as in case of impulsive people it is rather a way to

escape the incoming information, which is a barrier to the development of cognitive structures.

Research of Matczak (1982b, 1991b, 1997) the relationship between cognitive style and intellectual abilities have proved that only the number of wrong answers in the MFF test negatively correlated with the number of points achieved in the Raven test. In contrast, there was no association of the results with response time. Research of Quiroga et al. (2011) suggest, however, that reflection-impulsivity are associated with the decision-making process, and intelligence plays a minor role in the differentiation of the studied groups. Research by Ledzińska, Battala and Stolarski (2014) confirm the assumption that the decision-making time is the most important predictor of reflection-impulsivity.

**Developmental changes in reflection-impulsivity**

So far, there are few data on developmental changes in this area, although one collected rich material about changes with age in terms of individual abilities determining the reflection of behavior (com. Matczak, 1982b). It is known that the reflection in children increases with age, and the trend is noticeable in different cultures. Reflection-impulsivity dimension is revealed as early as in preschool age, and preferences are developed quite early and are characterized by a relatively high stability.

Answer about the significance of changes in this field are provided in a theory of mental development by Piaget (1991, 2006). The formation of the reflection is influenced by the transition from the stage of preoperative thinking to specific and then formal operations. As a result, the child realizes that the first best solution to a problem is not the only one possible. In a further development, the child becomes able to apply methods enabling the consideration of all available possibilities of solutions, and finally the final choice. Another ability contributing to the development of reflection is critical thinking and the related slowdown in the rate of thinking. Furthermore, it was found that individual differences in this area are mainly found in younger children, and tend to fade with age. Matczak (1982b) emphasizes, however, that if the differences between reflective and impulsive people were not caused by the difference of the pace of development, then in the studied dimension one would observe rather the advantage of the individual differences over developmental ones. It should be noted that previous research on the discussed cognitive style included only children in preschool and school age.

So far, a few attempts were taken to study the reflection later in life, focusing on childhood, which is an important prerequisite to undertake research in the adulthood (com. Matczak, 1992). For example, in studies of Coyne and colleagues (1978) it was found that older adults were more impulsive than younger ones, there was a shorter latency and more errors in case of older people. This result may indicate the presence of impulsivity in the elderly, but can also indicate a deterioration in cognitive functioning that causes committing more errors. This result tends to reflect the specificity and stability of reflection-impulsivity indicator in aging humans, in

which there is a general slowing of cognitive function and appearance of the natural changes – also of a deficit – in the area of information processing.

**Reflection-impulsivity measurement**

Measurement of the dimension of reflection-impulsivity includes an assessment of the speed and accuracy of response tested in such tasks, where these two characteristics are negatively correlated with each other (Matczak, 1992). Tasks to measure this trait should not require complex processes of reasoning, or the share of long-term memory, but must cause a significant degree of uncertainty as to which solution is correct. Thus, the optimal degree of difficulty of tasks is a necessary condition for the diagnostic value of the tasks leading to the above-described negative correlation.

The studies used mainly tasks consisting in searching among similar objects of the ones which are identical in accordance with a specified pattern. The most commonly used research methods include the Matching Familiar Figures-MFF test, the Delayed Recall of designs-DRT test and Haptic-Visual Matching-HVM test. The MFF and DRT tests refer to visual observations, and HVM test also to the tactile perceptions. In the case of MFF test, the objects for comparison with the pattern are presented at the same time, while in the DRT and HVM tests after a period of deferment. These methods pose before the subject the problems of a converging nature, provide possible solutions and the number of possible responses, as well as require a simple form of categorizing objects according to the criterion "the same-different".

Based on the results obtained in the MFF test it is concluded that the reflection is manifested at less than the median response times and less than the median number of errors. This method proposed by the author of the test is defined as a classic indicator of reflection-impulsivity. This method, however, has many limitations. Matczak (1992) indicates that short response times and a small number of errors can arise from an apparent ease of the task, and at the same time of extraordinary capabilities of the subject. In contrast, long response times may indicate low possibilities of the subject, as well as the difficulty in concentration, personal characteristics, fear of answering. It should be stressed that only the combined use of both components allows the diagnosis of the dimension of reflection-impulsivity. It also happens so that during the test there are responders who give answers quickly and correctly, and slowly and wrong, which can indicate the presence of relatively stable individual preferences, which makes these person neither reflective nor impulsive. This method of diagnosis does not always allow to determine cognitive style in all subjects, because in about 40% this figure will be higher or lower in relation to the group median.

For calculation of the results in the MFF test one can also apply other indicators (Matczak, 1992). Most often it is an indicator including response time and number of errors. There is, inter alia, an impulsivity indicator showing the difference between the number of errors and response time, which is converted to standard scores. In addition, there is a rank reflection indicator which value is a rank of the sum of ranks obtained by the test in terms of response time (in ascending order)

and the number of errors (in descending order). The rank indicator order, however, will inform about the reflection-impulsivity against the group, and will not be used to diagnose an individual, because it is most commonly used in clinical or research groups. It is determined by ordering the identified group response times in order from lowest to highest, and the number of errors in reverse. In psychological practice, the MFF test is primarily used as a complement to the diagnosis of intellect, because cognitive style is an important factor determining the degree of use of intellectual capacity.

For the final diagnosis of cognitive style, an important role is played by the correct interpretation of the results obtained by the respondent (Matczak, 1992). For example, borderline or moderate results in terms of reflection may indicate a positive incentive to perform cognitive tasks, as well as a realistic self-assessment of own abilities. Extreme results, especially in terms of reflection may be indicative of a high cognitive activity and strong motivation to complete the task and indicate the mastery of strategy of control or excessive caution. High scores in the scope of impulsivity the most often mean that a person does not feel the need to exercise control over her own cognition (aspect of motivation) and she has not mastered the relevant strategies of control (low level of metacognitive ability). It is worth noting that the problem of measuring the reflection-impulsivity became the subject of lively scientific discussion between Block et al. (1974, 1986) and Kagan and Messer (1975). The value of the test was also questioned by Becker with the team (1978). Block, Block and Harrington (1974) have questioned the accuracy of the MFF test, because their research revealed a lack of correlation between the response time and behavioral and personality variables with simultaneous correlation of errors with intellectual competence. Kagan and Messer (1975) believed, however, that these accusations can be weakened by two premises. Firstly, reflection-impulsivity measured by the test is the only feature of cognitive style, which manifests itself in a particular class of situations of solving problems. Secondly, the response time and the number of errors must be recognized together. Finally, the discussion was not resolved, but thanks to it attention was paid to methodological problems associated with measuring the reflection-impulsivity in people at all ages. Left unanswered was the question of what happens to the index of reflection-impulsivity when with the increase in the number of errors increased also the response time.

## The aim of study

The main purpose of own research was to examine whether people in early, middle and late adulthood differ in terms of cognitive style reflection-impulsivity as measured by the MFF test. Among the Polish researchers Matczak (1982a, 1982b, 1990, 1991a, 1991b, 1996, 1997) has conducted several studies on reflection -impulsivity in people of school age, in the period of adolescence and early adulthood. Her research has showed that in each of these groups, the number of errors significantly negatively correlated with response time, which can justify the application of  MFF test in people at all ages. Another argument for the use of this test in different age groups is the fact that adult response times are shorter than in

case of children at school age, and the number of errors – comparable. This may prove the usability of the MFF test to study youth and adults, even in its original form. Previous studies by Matczak have indicated, among other things, that the average response times for groups: school age, adolescence and adulthood are almost identical. It has been observed that the accuracy of the provided answers increases in school-age and adolescence, in case of young adults it reaches a level typical for the end of school age. It also indicated that the data on the development of reflection trend are consistent with assumptions about the increase of reflection with age, but these trends were less pronounced than expected. The researcher stresses that the attempts to study reflection and impulsivity in adults are scarce and knowledge incomplete, which is confirmed by the carried out by us analysis of the results in the introduction to this article. Taking up the subject of reflection--impulsivity in adulthood may supplement the gaps and indicate future directions of research in this area.

The research has also studied the previously not undertaken in the literature issue of adequacy of reflection-impulsivity indicator based on the number of errors and response time for the determination of cognitive style of adult subjects, especially with regard to persons in late adulthood. Based on the current knowledge about cognitive functioning, it can be assumed that in case of people in late adulthood, who also present a general slowing down of cognitive processes, response times will be longer than in younger age (Salthouse, 2012). It can be assumed that the lengthening of the response time will contribute to the determination of older people to be more reflective than younger people. This prompted us to reflect on the nature of the reflection-impulsivity indicator in adulthood (see Analysis of results).

## Method

For measurement of the variables one has used the *Matching Familiar Figures Test*. The author of original test is Kagan (see Kagan, Pearson, Welch, 1966), and the Polish adaptation was made by Matczak (1992). In practice, this test is used as a complement to the diagnosis of intellect. In the studies one found an association between reflection-impulsivity and school grades. The test consists of 12 proper tasks and 2 trials. The test material is of pictorial character. The task of the subject involves searching among the six variants of the picture of the one which is identical to the model presented at the same time. If the subject does not indicate the correct picture, one asks for another indication, saying: *No, not this one. Find the one that will be exactly the same as the model*. One records all the answers of the subject, until indicating an image conforming to the model and measures time of reflecting on the first response. The test is performed individually, and the average execution time is about 15 minutes. The MFF test procedure does not limit the time of the task performance. The MFF test has a satisfactory internal compliance and absolute stability and theoretical accuracy. The Polish normalization was prepared on the basis of the established interim standards (mean, median, quartiles, standard deviation) for children aged 9-17 years. It should be emphasized that the previous studies indicated a theoretical accuracy of this test as a tool for measurement of reflection-impul-

sivity in people at all ages of life, therefore it is reasonable to apply the test material to adults (Matczak, 1982b). The proper measurement refers to the time of thinking about the first response and number of errors, and then the average time of thinking about the answers and the number of errors made are calculated.

For the needs of own research, a computer version of the test was prepared with preservation of the procedure of original test in cooperation with an IT specialist[1]. Such form of the test enabled a precise and automatic measurement of time of the first response, presentation of the material in a method comfortable for the elderly (screen with a diagonal of 22 inches) and facilitated giving answers (numerical keypad). The test performance took from a few to several minutes.

**Participants**

The study was participated by 180 adults living in Bydgoszcz. The group of subjects was balanced in terms of age (three age categories: 20-35 years – early adulthood, 36-59 years old – average adulthood and 60-80 years – late adulthood) and gender and level of education (primary, secondary, higher). The characteristics of the subjects based on age are presented in table 1.

Table 1. Characteristics of the subjects based on age ($N = 180$)

| Sex | Age | | $M$ | $SD$ |
|---|---|---|---|---|
| Early adulthood ($n = 60$) | | | | |
| Women ($n = 30$) | 23.87 | 4.64 | 24.8 | 4.66 |
| Men ($n = 30$) | 25.71 | 4.57 | | |
| Middle adulthood ($n = 60$) | | | | |
| Women ($n = 30$) | 48.87 | 8.52 | 48.27 | 7.85 |
| Men ($n = 30$) | 48.55 | 7.22 | | |
| Late adulthood ($n = 60$) | | | | |
| Women ($n = 30$) | 66.71 | 4.95 | 67.63 | 5.52 |
| Men ($n = 30$) | 68.44 | 5.39 | | |

Source: own description

Initially, the choice of the subjects was carried out by a method called snowball sampling. The request for the execution of the task was primarily directed to pupils, students, employees of companies and the elderly, and then they were asked for indication of more people able to take part in the study. Then, the procedure of a deliberate selection was started through the selection of persons applying for participation in the study. The main criterion for selection was age and gender, an additional one – good psychophysical condition of respondents.

## Results

In the first step of the analysis, people from different age groups were compared in terms of accuracy and speed of execution of tasks in the MFF test. This comparison was aimed to determine whether in the study group one can observe age-related decrease in the speed described in the hypothesis of a general slowdown and whether there are also age-related differences in terms of correctness.

When it comes to **correctness,** it is the highest among young adults, intermediate in subjects in mid-adulthood and the lowest in the elderly (see. figure 1). However, as indicated by the results of the analysis of variance, the differences are not statistically significant ($F[2, 178] = 2.21$; $p = .11$; $\eta^2 p = .02$).
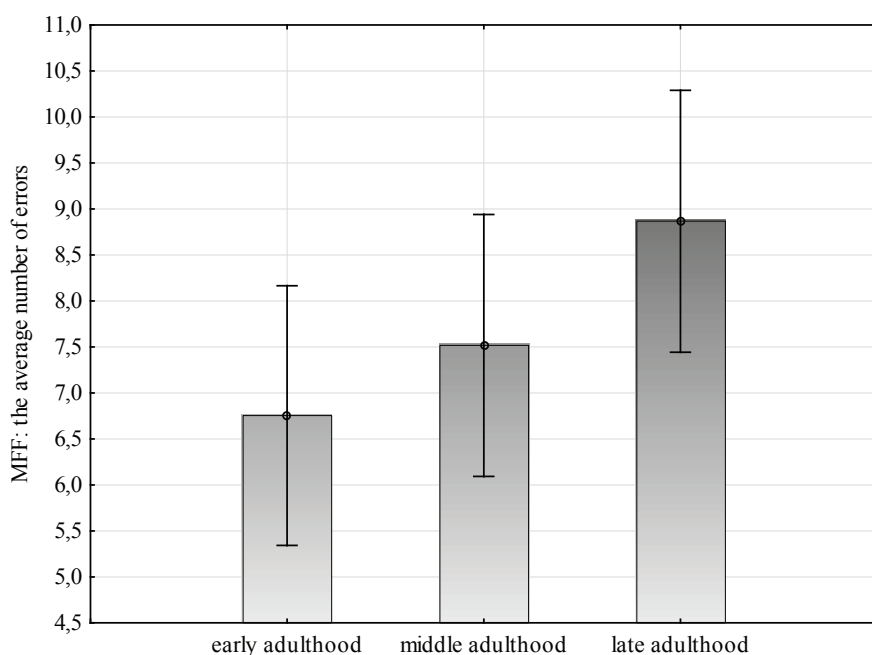


Figure 1. The average number of errors in the MFF test in age groups of early, middle and late adulthood
Source: own description

Age groups vary significantly in terms **of response time** ($F[2, 178] = 17.54$; $p < .001$; $\eta^2p = .16$). The response time is the longest among the oldest subjects, intermediate in individuals in middle adulthood and the shortest among the youngest (see. figure 2). While the post hoc analyses using the Scheffe test show significantly longer response times in the age group of late adulthood as compared to early adulthood ($p < .001$) and middle one ($p = .001$), with no statistically significant differences between groups in early and middle adulthood ($p = .11$).
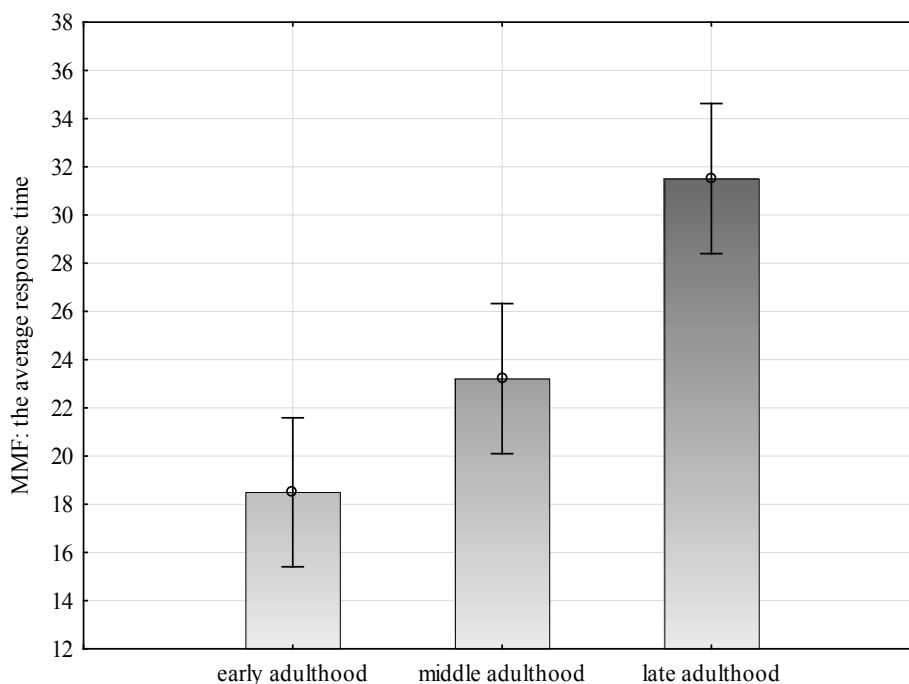


Figure 2. The average response time in MFF test in age groups of early, middle and late adulthood

Source: own description

In the next step of analysis, the age groups were compared in terms of **reflection-impulsivity**. In this analysis one used two indicators from MFF test: (a) the difference between the number of errors and the response time expressed in seconds (see. figure 3), and (b) the ratio of errors number to the response time expressed in seconds (see. figure 4 ). The first indicator is traditionally used in the MFF test, while the second one was introduced due to the significantly longer response times in case of the elderly. Due to the slow down of response times of the elderly, the indicator based on the difference between the number of errors and the time of response may be distorted in this group. Significant prolongation of the reaction with an unchanged validation leads to a significant increase in the value

of the difference: the number of errors minus the response time, which can lead to a false recognition of reflection. The indicator based on the ratio of number of errors to the response time is more resistant to speed decreasing with age.

In the case of using the first indicator, i.e. **the difference between the number of errors and the response time**, the differences between the age groups were statistically significant ($F[2, 178] = 9.51$; $p < .001$; $\eta^2 p = .10$). The post hoc analyses with use of Scheffe test have shown that older people are significantly more reflective than people in early adulthood ($p < .001$) and middle adulthood ($p = .02$), but between the latter two groups there are no statistically significant differences ($p = .30$).
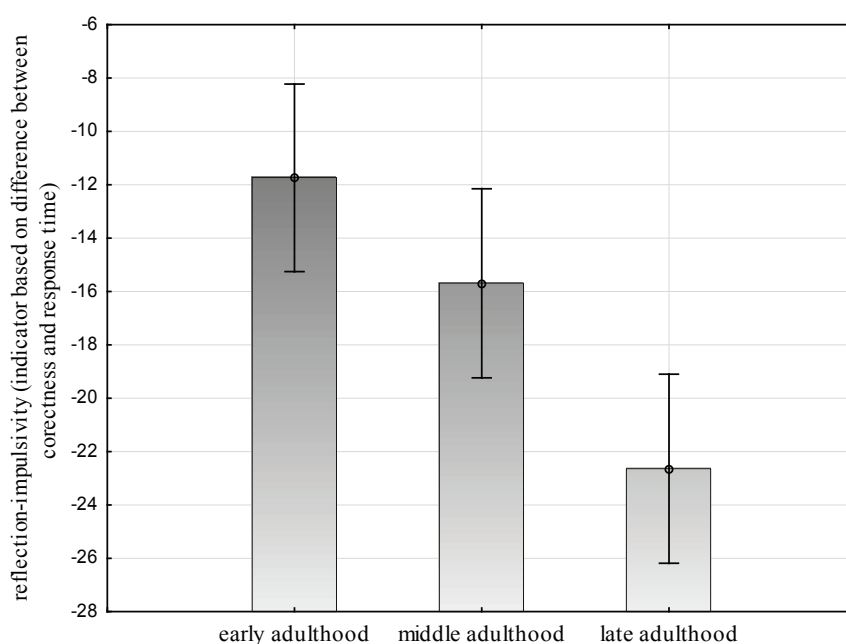


Figure 3. Reflection-impulsivity (indicator based on the difference between correctness and response time in the MFF test) in the age groups of early, middle and late adulthood
Source: own description
*Note:* The lower the value of the indicator the higher reflection

The analysis of variance carried out for the other indicator – **the proportion of the response time and the number of errors** – revealed significant differences between age groups, but in this case the value of the effect was lower ($F[2, 178] = 3.24$; $p = .04$; $\eta^2 p = .03$). The Scheffe test on the other hand indicated that even for the highest from the observed differences, i.e. higher reflection in case of the elderly as compared to the young adults, the level of test probability slightly exceeds .05 ($p = .051$), while there are no statistically significant differences between groups of middle and late adulthood ($p = .81$) and early and middle adulthood ($p = .20$).
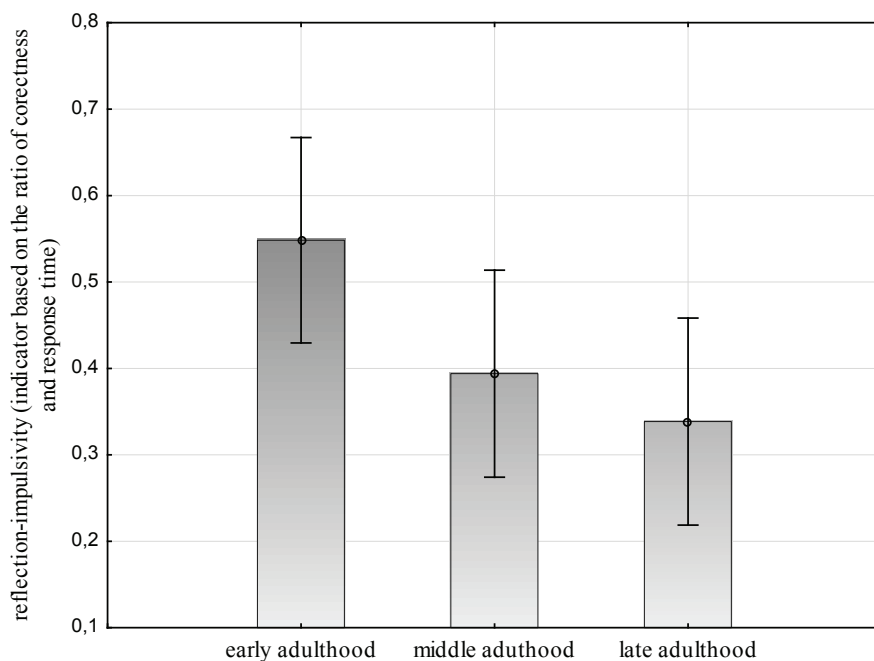
Figure 4. Reflection-impulsivity (indicator based on the ratio of correctness and response time) in the age groups of early, middle and late adulthood

Source: own description

*Note:* The lower the value of the indicator the higher reflection

The observed higher reflection among the elderly can be a development regularity, but also may be an artifact resulting from the described in the literature and confirmed by the results of this study elongation of the response times in the aging process, with no significant increase in the number of errors. The results suggest that the use of reflection-impulsivity indicator based on the relationship between speed and correctness in the MFF task in case of the elderly may be a mistake.

Therefore, the third step of analysis was undertaken, the aim of which was to determine whether in all age group, especially in the late adulthood group, there is the assumed relationship between speed and correctness, which is the basis of diagnosis of reflection-impulsivity, i.e. **negative correlation between these two parameters of the task** (Matczak, 1992). This correlation was statistically significant only in the age group of early adulthood ($r = -.51$; $p < .001$). There is however a significant relationship between speed and correctness of the MFF test performance not only in the age group of late adulthood ($r = .07$; $p = .58$), but also in the group of middle adulthood ($r = -.11$; $p = .39$). Lack of the assumed relationship between the aspects of speed and correctness among people in middle and late adulthood is an argument against the use in these age groups of reflection-impulsivity indicators based on this relationship.

_____ strona 583

# Discussion

At the beginning, we would like to point out the limitation of the study, which was mainly due to the methods applied by us. The MFF test, which is designed exclusively for children and adolescents up to 17 years of age (due to the Polish normalization), has been used in relation to persons who are in early, middle and late adulthood. Let us note, however, that this test was not used by us to diagnose individual – thus we did not refer to the existing standards, and solely scientific studies examining the problem of reflection-impulsivity in adults. In our opinion, a significant limitation of this method is the nature of the test material (only pictorial), its complexity (small differences in level of difficulty, tasks were rather easy) and recommended method of measurement of two indicators of task performance (com. Method). Being aware of the existing limitations, below we present the principal conclusions of own research.

Referring to the main purpose of own research, we can conclude that subjects in early, middle and late adulthood differ in terms of cognitive style of reflection--impulsivity as measured by the MFF test. The results indicate that the subjects in adulthood differ in terms of reflection-impulsivity expressed as the difference between the number of errors and response time. These differences occur between the young and the oldest adults and the subjects in middle and late adulthood. On this basis, it can be concluded that the elderly are more reflective than persons in early and middle adulthood, which corresponds to our initial assumptions. This result is an important addition to knowledge on reflection-impulsivity in adulthood, because past research reports concern mainly children, adolescents and people entering adulthood (com. The aim of study). Because of the fact that the nature of developmental changes in the scope of this dimension of cognitive style is not yet fully known, one could only assume that those who are the oldest are more reflective than younger people in the situation of solving the cognitive problem. We believe that the increase in reflection in cognitive functioning of older people may be due to different strategies used during problems solving, which is suggested also by reports of other researchers (com. Baltes, 1997; Sędek, von Hecker, 2004). However, we wish to emphasize the fact that this result raises our doubts, as explained later in this article.

On the basis of the detailed analyses it turned out that the oldest respondents solve the tasks the longest, which is in line with our expectations. Previous studies clearly show that older age is associated with a reduction in cognitive achievements in performed tasks and cognitive processes are slowed down by a constant ratio, which in turn increases the differences in response times (com. Salthouse, 2000; Birren, Schaie, 2006). Older adults are slower than younger ones, even in the case of simple and undemanding cognitive tasks, that is, similar to those encountered in our study. At the same time, in such tasks the elderly are not less correct, which kind of deforms the indicator, as discussed further. The most probable and certain factor lowering the performance of cognitive tasks in old age is the so called general slowing down of cognitive processes (among others Salthouse, 1992, 2000). It results,

among other things, from the progressive degradation of nerve tissue, and the lack of training in the course of solving the cognitive tasks.

Own studies indicated that the correctness of tasks solution is no different in case of adult subjects, therefore both younger and older adults solved the tasks at the same level. Older adults generally do not worsen in simple tasks, and age-related differences are more pronounced at higher cognitive load. The obtained result is part of a trend of studies that confirm the existence of the possibility of compensating natural cognitive limitations due to aging (com. Baltes, 1997). This compensation is made mostly by choosing other ways of doing things, the acquisition of new skills, mobilization of effort and commitment, as well as better management of problematic situations. In other words, older people, despite the limitations resulting from the cognitive aging can function efficiently and effectively by developing strategies different from those used by young people. An example could be the research results published by Sędek and von Hecker (2004), in which the elderly receive the best results in the most demanding tasks. Researchers have argued that aging adults can allocate information processing resources in the most economical way than younger people, because they use the guidelines contained in the tasks to be solved more accurately and study them longer.

Based on well-established knowledge about the cognitive functioning of older people and nature of the reflection-impulsivity indicator, the results led us to consider the adequacy of the indicator used in the MFF test for adults, which was specifically justified in the above analysis of results. As a result of our analysis, we found that depending on what method to calculate the reflection-impulsivity one applies, participants will get different results in the diagnosis of cognitive style, which further confirmed our doubts with regard to the reflection-impulsivity indicator in adulthood. This doubt was further confirmed by the fact of occurrence of negative significant correlation between response time and the correctness of the response only in participants in early adulthood (com. Results), and the presence of this inversely proportional speed-correctness relationship is a prerequisite of adequacy of the indicator based on it. We would like to remind that in the first step of analysis, it turned out that the subjects in adulthood differ in reflection--impulsivity expressed as the difference between the number of errors and response time. Differences were observed between the young and the oldest adults and the subjects in middle and late adulthood. On the basis of this result we concluded that the elderly are more reflective than the person in early and middle adulthood. On the other hand, when the reflection-impulsivity indicator was used based on the percentage of errors and response times, the previously observed differences became less pronounced and the statistical effect was weaker.

In conclusion, on the basis of the obtained results it can be assumed that the reflection-impulsivity indicator expressed as the number of errors and response time is suitable only for young adults and older one should seek other indicators of this variable. An important conclusion from research carried out by us is the fact that due to the lengthening of response time with age in the absence of significant changes to the correctness, the application of reflection-impulsivity indicator

based on the difference of errors and response time during the middle and late adulthood is inadequate. Solving the problem of reflection-impulsivity indicator in adulthood, especially among the oldest people, could be studied taking into account the strategies used during problem solving. This, in our view, sets the future direction of research on this issues and is an inspiration to undertake further research. For example, in the course of pilot studies, one should determine several behavior indicators that describe the reflective and impulsive cognitive style of the subjects, and then verify them on a group of adults. A useful method could be a technique of the thinking aloud which is based on reporting by the subject of thoughts appearing during the solution of tasks (com. Ericsson, Simon, 1993). This technique is, admittedly, limited by a level view of the patient into the process of thinking, but allows for accurate monitoring of the process of reasoning when solving a variety of tasks.

## References

Baltes, P.B. (1997). On the incomplete architecture of human ontogeny: Selection, optimization, and compensation as foundation of developmental theory. *American Psychologist*, 52, 366-380.

Becker, L.D., Bender, N.N., Morrison, G. (1978). Measuring Impulsivity-Reflection: a critical review. *Journal of Learning Disabilities,* 11, 10, 24-30.

Birren, J.E., Schaie, K. W. (red.), (2006). *Handbook of the psychology of aging, 6th Edition.* Burlington, MA: Elsevier Academic Press.

Block, J., Block, J.H., Harrington, D.M. (1974). Some misgivings about the MFFT as a measure of reflection-impulsivity. *Developmental Psychology,* 10, 5, 611-632.

Block, J., Gjerde, P.F., Block, J.H. (1986). More misgivings about the MFFT as a measure of reflection-impulsivity: absence of construct validity in preadolescence. *Developmental Psychology,* 22, 6, 820-831.

Borkowska, A. (2005). Impulsywność poznawcza w zespole ADHD [Cognitive impulsivity in ADHD]. *Psychologia Rozwojowa,* 10, 3, 145-156.

Coyne, A.C., Whitebourne, S.K., Glenwick, D.S. (1978). Adult age differences in reflection-impulsivity. *Journal of Gerontology,* 33, 3, 402-407.

Ericsson, K., Simon, H. (1993). *Protocol Analysis: Verbal Reports as Data*. Boston: MIT Press.

Kagan, J., Messer, S.B. (1975). A reply to "Some misgivings about the MFFT as a measure of reflection-impulsivity". *Developmental Psychology,* 11, 2, 244-248.

Kagan, J., Pearson, L., Welch, L. (1966). Modifiability of an impulsive tempo. *Journal of Educational Psychology*, 57, 583-694.

Kogan, N. (1976). *Cognitive styles in infancy and early childhood.* New Jersey: Lawrence Erlbaum Associates.

Kozhevnikov, M. (2007). Cognitive styles in the context of modern psychology: toward integrated framework of cognitive style. *Psychological Bulletin,* 133, 3, 464-481.

Ledzińska, M., Battala, M.J., Stolarski, M. (2014). Cognitive styles could be implicity assessed in the Internet environment: reflection-impulsivity is manifested in

individual manner of searching for information. *Journal of Baltic Science Education*, 13, 1, 133-145.

Lipowska, M. (2011). *Dysleksja i ADHD – współwystępujące zaburzenia rozwoju. Neuropsychologiczna analiza deficytów pamięci [Dyslexia and ADHD – comorbid developmental disorders. The neuropsychological analysis of memory's deficits].* Warszawa: Wydawnictwo Naukowe Scholar.

Matczak, A. (1982a). Rozwojowe i temperamentalne uwarunkowania refleksyjności--impulsywności [Developmental and temperamental conditions of reflection-impulsivity). W: J. Strelau (red.), *Regulacyjne funkcje temperamentu [Regulatory functions of temperament]* (s. 121-140). Wrocław: Zakład Narodowy im. Ossolińskich.

Matczak, A. (1982b). *Style poznawcze. Rola indywidualnych preferencji [Cognitive styles. Role of individual preferences].* Warszawa: Państwowe Wydawnictwo Naukowe.

Matczak, A. (1990). Reflection-impulsivity, need for stimulation and intellectual potentialities. *Polish Psychological Bulletin,* 21, 1, 17-25.

Matczak, A. (1991a). Wpływ zmodyfikowanych warunków badania testowego na efektywność funkcjonowania dzieci refleksyjnych i impulsywnych [Influence of the modified terms of testing on the effectiveness of functioning of reflective and impulsive children]. *Psychologia Wychowawcza, 34,* 1, 57-67.

Matczak, A. (1991b). The effect of modified testing conditions on the efficiency of reflective and impulsive children (in The Raven Progressive Matrices). *Polish Psychological Bulletin,* 22, 4, 277-287.

Matczak, A. (1992). *Test Porównywania Znanych Kształtów (MFF) J. Kagana [Matching Familiar Figures Test by J. Kagan].* Warszawa: Pracownia Testów Psychologicznych PTP.

Matczak, A. (1996). W poszukiwaniu nowych sposobów pomiaru refleksyjności--impulsywności [In search of new ways of reflection-impulsivity measurement]. *Psychologia Wychowawcza, 39, 2,* 156-171.

Matczak, A. (1997). Styl poznawczy a efektywność zapamiętywania materiału o różnej strukturze [Cognitive style and the effectiveness of remembering the material with different structure]. *Psychologia Wychowawcza*, 30, 5, 489-503.

Messer, S.B. (1976). Reflection-impulsivity. A review. *Psychological Bulletin,* 83, 6, 1026-1052.

Nosal, C. (1979). *Mechanizmy funkcjonowania intelektu: zdolności, style poznawcze, przetwarzanie informacji [Mechanisms of intellectual functioning: abiblities, cognitive styles, information processing].* Wrocław: Wydawnictwo Politechniki Wrocławskiej.

Piaget, J. (1991). Rozwój percepcji jako funkcja wieku [Development of perception as function of age]. W: P. Fraisse, J. Piaget (red.), *Zarys psychologii eksperymentalnej [Outline of experimental psychology]* (s. 181-242). Warszawa: Wydawnictwo Naukowe PWN.

Piaget, J. (2006). *Jak sobie dziecko wyobraża świat [How does child imagine a world].* Warszawa: Wydawnictwo Naukowe PWN.

Quiroga, M.A., Martinem-Molina, A., Lozano, J.H., Santacreu, J. (2011). Reflection-impulsivity assessed through performance differences in a computerized spatial task. *Journal of Individual Differences*, 32, 2, 85-93.

Radziwiłłowicz, W. (2004). *Rozwój poznawczy dzieci w młodszym wieku szkolnym [Cognitive development at younger school age]*. Kraków: Oficyna Wydawnicza Impuls.

Salthouse, T.A. (1992). *Mechanism of age-cognition relations in adulthood*. Hildsale, NJ: Lawrence Erlbaum Associates.

Salthouse, T.A. (2000). Steps toward the explanation of adult age differences in cognition. W: T. Perfect, E. Maylor (red.), *Theoretical Debate in Cognitive Aging* (s. 238-300). London: Oxford University Press.

Salthouse, T.A. (2012). Consequences of age-related cognitive declines. *Annual Review of Psychology*, 63, 201-226.

Sędek, G., von Hecker, U. (2004). Effects of subclinical depression and aging on generative reasoning about linear orders: same or different processing limitations. *Journal of Experimental Psychology: General*, 133, 2, 237-260.

## POMIAR STYLU POZNAWCZEGO REFLEKSYJNOŚĆ-IMPULSYWNOŚĆ W DOROSŁOŚCI – WYNIKI BADAŃ WŁASNYCH

**Streszczenie**. Refleksyjność-impulsywność określa stopień, w jakim człowiek rozwiązujący zadania poznawcze rozważa trafność nasuwających się odpowiedzi, inaczej tempo poznawcze. Wskaźnikiem refleksyjności jest długi czas odpowiedzi i mała liczba błędów, a impulsywności – krótki czas odpowiedzi i duża liczba błędów. Głównym celem badań własnych było sprawdzenie, czy osoby w okresie wczesnej, średniej i późnej dorosłości różnią się stylem poznawczym refleksyjność-impulsywność.

W badaniach własnych wzięło udział 180 dorosłych osób. Do pomiaru zmiennej wykorzystano Test Porównywania Znanych Kształtów, w którym materiał testowy ma charakter obrazkowy. Uzyskane wyniki wskazują na wzrost refleksyjności u osób starszych, a także podejmują niedyskutowany dotąd problem adekwatności wskaźnika refleksyjności-impulsywności opartego na liczbie błędów i czasie reakcji dla określenia stylu poznawczego dorosłych, przede wszystkim w odniesieniu do osób będących w okresie późnej dorosłości.

**Słowa kluczowe**: refleksyjność-impulsywność, style poznawcze, dorosłość