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The meaning of the body schema in reaching maturity during late adolescence

Abstract: *The objective of the research presented in this paper was to investigate whether an association existed between the activation of the body schema and reaching adulthood among people in late adolescence. Three activities that are known to enjoy popularity among young people were analysed, namely: dancing, playing computer games that require motor involvement (e.g. Kinect), and playing computer games of an educational and entertaining character. It was assumed that the chosen forms of activity correspond to three levels of activation of the body schema. The following research methods have been applied to this study: the Rosenberg Self-Esteem Scale (SES), the Defence Style Questionnaire (DSQ), and the Bodily Self Representation Questionnaire. The study has proven that the activation of body schema through dance is significantly related to high self-esteem and the use of mainly mature and neurotic defence mechanisms in threat situations.*

Keywords: *body schema, body self, self-esteem, defence mechanisms, late adolescence*

Introduction

The central instance responsible for experiencing oneself in a bodily dimension is the body self (Krueger, 2002). It constitutes the first, and at the same time fundamental subsystem of self, the functioning of which is based on the organising of somatosensory experiences into ever more complex psychical body representations, above all the body schema and the body image (Mirucka & Sakson-Obada, 2012). This specification and clarification related to the body self was performed for the first time at the beginning of the 20th century by two neurophysiologists, Head and Holmes. Their differentiation between the body schema and the body image is considered at present as classic and, at the same time, as organising the body experiences of the subject in the best way (Gallagher, 2005). According to Gallagher (2005), the body image is a system of mental representations relating to the body. These could be observations and beliefs, as well as body-related emotions. On the other hand, the body schema is a system of neuronal representations that allows constant regulation of the subject's posture and movements (the so-called "neuromatrix"). The main differences between the body schema and the body image are anchored to the dissimilarity between such concepts as perception and body movement. The body image is related to having specific observations, while the body schema concerns motor capacities and control over one's own body (Gallagher, 2005). Generally speaking, the body image and the body schema constitute the two most central body-related representation systems, generated as a result of the process of experiencing the bodily self. In correct development, these two phenomena create an integrated whole (one system), which decides to a large extent on the bodily identity of the subject, amongst others on the feeling of bodily self-continuity in time and space, the feeling of internal coherence, the feeling of one's own boundaries, as well as acceptance of oneself as a bodily being (Mirucka & Sakson-Obada, 2012).

The development of the body self takes place throughout the subject's lifespan. It becomes exceptionally intense when significant changes in body appearance happen. During the adolescence period, when a significant body transformation takes place and the body gains feminine or masculine attributes, girls' and boys' preoccupation with their own body becomes very intense (Smolak, 2004). Its most common effect is dissatisfaction with one's external appearance, which can be experienced as dissatisfaction

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with oneself (Eisenberg et al., 2006; Knauss et al., 2008; Presnell et al., 2004). There is a risk that the process of identity shaping will be dominated by the processes of shaping the silhouette and external looks (Markey, 2010). Previous research suggests an association between identity development and body image. According to Clay, Vignoles, and Dittmar (2005), body image has a major influence on adolescents' self-esteem, and appearance is a highly significant aspect of adolescent identity. Not only changes in body shape but also in physical activity alter the psychological well-being of adolescents. Their physical activity plays an important role in the perception of the body and self-esteem of adolescents (Altinta et al., 2014).

In the literature on the subject attempts were made to analyse the relations between the body image and various adolescents' maturity indicators in a thorough and detailed manner, amongst others in terms of self-esteem (Altinta et al., 2014; Clay, Vignoles, & Dittmar, 2005;), identity status (e.g. Huang et al., 2007; Kamps & Berman, 2011), as well as with low level of unhealthy behaviours (e.g. Cash & Deagle, 1997; Rosen, Reiter, & Orosan, 1995). To the best of our knowledge, no research was done on the second, equally important representation of the body self – the body schema and its significance in the adolescents' realisation of developmental tasks. The question is about the relationship between the body schema and 1) highly adaptive (mature) ways of coping with fear, protecting the integration of the self (i.e. defence mechanisms), and 2) self-esteem, which is a strong predictor of mental health.

The body schema is the most primary and central system of representation concerning the body. Its privileged position among other bodily representations can be attributed to the role it fulfils in the process of monitoring and using the body. Because of the pragmatic goal of being able to move and control one's own body, the body schema is understood as a basic neural structure known as the neural matrix (Stamenov, 2005). It organizes the somatosensory experiences: interoceptive, proprioceptive, kinaesthetic, and tactile. The structuring of these sensations is done in the form of maps that show multi-modal aspects of the present body state and the functioning of the organism (Gallagher, 2005; Mirucka & Sakson-Obada, 2012). The processes connected with the body schema (i.e. schematic bodily processes) are dynamic and include assimilation and accommodation – in Piaget's understanding of the terms – and engage in a constant interaction with the environment. The subject changes his or her posture and movements, and completes intentional actions all owing to the body schema. Because of the variety of functions the body schema fulfils, it is characterised by a multi-sensory integration and dynamic plasticity (Gallese & Sinigaglia, 2010).

According to Jacob and Jeannerod (2005), the body schema is a complex phenomenon that can be expressed in two dimensions: kinaesthetic and kinetic. The first dimension, kinaesthetic, is grounded in proprioception, which provides information about muscular tension, static body position, body posture, stretching of the skin and muscles, balance, and so on. Owing to the first dimension,

it is possible to experience oneself as an object with specific parameters (e.g., weight, density, temperature, etc.) located in a three-dimensional space. The body schema in the kinaesthetic dimension – in a normative development of the subject – forms the basis for experiencing oneself as an indiscrete whole, integrated from different parts or organs (i.e. awareness of body form), which functions in a spatial reality (i.e. awareness of the body in space). On the other hand, the kinetic dimension concerns the unconscious processes that continuously regulate posture and movement, which result in functional body maps or procedural representations that form the basis for many actions and behaviours of the subject. The body schema in this dimension gives the subject a sense of a moving self, completing the actions of both gross and fine motor skills. As a result, this dimension is a source of experiencing one's body as a tool to perform conscious or unconscious actions (Legrand, 2006; Tsakiris & Haggard, 2006).

The awareness of the body form, body spatiality, and the feeling of movement and being a tool for action lay a foundation to create more complex experiences. Ultimately, the body schema is responsible for basic identity feelings, including the awareness of one's own body (i.e. the feeling of one's corporeality as a psychosomatically integrated object), and the feeling of agency and being the subject of one's own actions (Rossetti et al., 2005; Tsakiris & Haggard, 2006; Tsakiris, Schultz-Bosbach, & Gallagher, 2007; De Vignemont, 2011).

It is suggested that the role of the body schema in the subject's functioning in the identity dimension, especially during times of intensified processing of forming one's identity, may play a positive role. It could mean that during the period of adolescence, when it is critical to find an answer to the question, "Who am I?" (i.e. the reflective formation of identity) (Oleś, 2008), the body schema, or more precisely, the activation of the body schema, is probably strongly related to the consolidation of one's sense of identity. In other words, every activity that includes experiencing the bodily self (and especially the body schema) should, to a varying degree, facilitate experiencing one's subjectivity, thus allowing the individual to reach maturity. An expression of this phenomenon would be an increasing feeling of the ability to control and direct one's own body, essentially a feeling of effectively managing one's actions (i.e. the sense of agency and efficacy). As a consequence of these identity feelings, based on the body schema, self-esteem is likely to increase, as well as a more positive attitude towards the self (cf. Bandura et al., 1999; Vignoles, 2006). It can be expected that people in late adolescence who systematically undertake physical activity would be characterised by a higher degree of body schema development. Moreover, their body image should show features of correct and high-level functioning because of a natural integration with the body schema.

Self-esteem is the evaluative and affective dimension of the self concept (Harter, 1990). It refers to a person's global appraisal of his/her positive or negative value in different roles and domains of life (Hazel & Nurius, 1986). It constitutes a sort of internal guiding mechanism which

strengthens the subject in his/her initiatives and actions through life (Seligman & Csikszentmihalyi, 2000). Self-esteem increases during adolescence, young adulthood, and middle adulthood, reaching a peak at 60 years, and then declining in old age. It is relatively stable, which means that individuals with high (or low) self-esteem at one stage of life are likely to have relatively high (or low) self-esteem even 2–3 decades later (Orth, Maes, & Schmitt, 2015). Self-esteem is a predictor of success and well-being in life domains such as relationships, work, and health. In general, self-esteem works as an important psychological factor that indicates successful versus problematic developmental trajectories (Orth & Robins, 2014).

It can be expected that people in late adolescence who systematically undertake physical activity would be characterised by a higher degree of body schema development. Moreover, their body image should show features of correct, high-level functioning because of a natural integration with the body schema. If we assume that one indicator of reaching maturity is self-esteem expressed in a positive evaluation of oneself, then, most likely, the activation of the body schema will be strongly related to self-esteem, which may indicate that a higher level of body schema activation corresponds to higher self-esteem.

The other indicator of maturity in late adolescence can be capabilities of managing emotions effectively, and coping with stress in a constructive way by using the high adaptive mental mechanism (Vaillant, 2000). According to current psychodynamic theories (Davidson & MacGregor, 1998), defence mechanisms are considered relatively stable response dispositions triggered by internal or external stress and conflict. Their crucial role is to protect self-esteem, and guard integration of the self in extremely difficult situations. Adaptive defensive functioning is positively associated with many aspects of psychological functioning, such as subjective happiness, psychosocial maturity, occupational success, satisfaction and stability of relationships, and absence of psychopathology (Vaillant, 2000). Defence mechanisms may be arranged in a hierarchy of their level of adaptiveness (maturity) (Perry & Henry, 2004). Andrews, Singh, and Bond (1993) proposed a 3-level hierarchy of defence mechanisms – from least to most mature. The first level, known as the mature level, includes 4 defence mechanisms: anticipation, humour, sublimation, and suppression. The second level, known as the neurotic level, includes idealisation, reaction formation, undoing, and pseudo-altruism. The last level, known as the immature level includes 12 defence mechanisms: acting out, denial, devaluation, displacement, conversion disorder, schizoid fantasy, isolation, passive aggression, psychological projection, rationalisation, somatisation, and splitting (Andrews et al., 1993). Therefore, it can be suspected that the activation of the body schema during adolescence is connected to the shaping of mental structures that are responsible for a mature way of overcoming fear and uncomfortable emotions in order to protect self-esteem and integration in the entire system of the self.

It is probable that distinct forms of activity will differ in terms of the degree of activation of the body schema, which is understood as (a) activating neural maps of multi-modal physical sensations that reflect the complex psychosomatic conditions of the subject; (b) increasing the readiness to act, the feeling of motion, and a sense of control over it; and (c) intensifying the experience of one's own causation and being an agent of one's own actions. It has been assumed that the more globally the subject is engaged in experiencing movement and space, the higher the degree of body schema activation becomes, which is accompanied by a stronger experience of oneself as a physical being (i.e. feeling of the bodily self). In other words, actions that engage the subject both in the area of gross and fine motor skills will have more opportunities to activate the body schema than those that require only particular movements to accomplish a specific act. This is reflected at a neural level in the form of activating larger areas of the brain (Stamenov, 2005).

For the purpose of this research, three very popular activities among young people were analysed: dancing, playing computer games that require movement (such as Kinect), and playing computer games that do not require movement (educational and entertaining). Sport, which is an important part of the educational curriculum, and an activity undertaken to a greater or lesser extent by all adolescent youths, was excluded from this research intentionally. It has been assumed that the selected activities correspond to the three levels of the activation of the body schema. The highest level, which activates the body schema along with other representations of the self in the most global and intensive way, is represented by dancing. It is most probable that, while dancing, the basic systems of bodily representations (e.g., body schema, body image, emotions concerning the body or feeling of one's self) are integrated.

The middle level, which is characterised by a moderate activation of the body schema, was assigned to Kinect. Produced by Microsoft for Xbox 360, Kinect is a movement sensor that performs a kinetic analysis of the human body by "dividing" it into 48 parts that are monitored in real-time. The device allows a player to control his/her character (avatar) using gestures and movements that engage the whole body. The accuracy and precision of movements, alongside agility and reflexes, allow a player to imitate the actions of the avatar to succeed in the game. The lowest level concerns a very weak activation of the body schema because of the limited engagement of the subject in the action. It would seem that this level of activation is best represented by computer games which require a player to solve logic problems and use manual dexterity in eliminating enemies, fighting against the AI[1] or other players. This kind of interactive entertainment is often called an "electronic sport", and it does not require complex movement from a player, whose task is to operate the controllers (a joystick, a pad) or a keyboard. Both types of computer games (i.e. Kinect and educational-arcade games) engage the body image to the smallest degree, if at all. The body schema and emotions

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[1] Artificial Intelligence.

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are the representations that are activated while playing those games.

The aim of the current study was to determine whether an association existed between the activation of the body schema and reaching maturity (in specific aspects such as self-esteem, and the use of mature defence mechanisms to cope with fear constructively) among teenagers in late adolescence. It was assumed that:

1) The distinct forms of physical activities such as a) dancing, b) playing Kinect games, and c) playing computer games differ in terms of the degree of activation of the body schema.
2) Activation of the body schema is positively associated with self esteem, which means that a higher level of activation of the body schema corresponds to higher self esteem in teenagers in late adolescence.
3) Activation of the body schema is related to the use of defence mechanisms in a threat situation, which means that teenagers involved in physical activities that activate the body schema at a higher level (in dancing) use mostly mature defence mechanisms.

Research Methods

Study group

The study was conducted with 93 participants; 40 of whom were female and 53 male, all aged between 16 and 23 (*M*=21 years, *SD*=2.11). All participants were assigned to one of the three groups in a non-random way. The criterion for assigning subjects to one of the groups was the type of activity most often undertaken during free time. Those who danced (modern dance, street dance, jazz, breakdancing) were assigned to the first group (called the DANCE group). The second group (called the KINECT group) was formed from people who devoted much of their weekly free time to computer movement games, such as Kinect. Committed users of educational and entertainment computer games formed the third group (the COMPUTER GAMES group). All groups were equinumerous, consisting of 31 people (cf. Table 1).

The intensity of the activity undertaken in each study group is presented in Table 2. All participants devoted, on average, more than 2 hours per week to the chosen activity. The average time (measured in hours per week) in the DANCE group was 2.62, while in the KINECT group it was 2.48. The COMPUTER GAMES group had a slightly higher average time of 3 hours per week. If we consider the high availability and the fact that computer games are very common, the difference is small and unimportant. No participant in either the KINECT or COMPUTER GAMES groups devoted time to dancing, while a few participants in the DANCE group devoted several minutes per week to Kinect (2 people) and computer games (7 people). Still, each group had a clearly defined dominant type of activity.

The average length of time involved with the chosen activity was as follows: 4 years in the DANCE group,

Table 1. Number of males and females in study groups

GROUP	WOMEN	MEN	TOTAL
DANCE	16	15	31
KINECT	11	20	31
COMPUTER GAMES	13	18	31
TOTAL	40	53	93

Table 2. Intensity of activity: dancing, Kinect, and computer games (hours per week)

Group (number of people/hours)	time spent on dancing (weekly)				time spent on playing Kinect games (weekly)				time spent on playing computer games (weekly)			
	t=0	t<1h	t>2h	average	t=0	t<1h	t>2h	average	t=0	t<1h	t>1h	average
DANCE	0	0	31	**2.62 h**	9	2	0	0.06 h	24	7	0	0.23 h
KINECT	31	0	0	0	0	0	31	**2.48 h**	18	13	0	0.42 h
COMPUTER GAMES	31	0	0	0	28	3	0	0.09 h	0	0	31	**3.00 h**

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[2] Kinect has been noted in the Guinness World Records as the "fastest-selling consumer electronics device", as it sold over 8 million copies in the first 60 days. In January 2012, the number of Kinect devices sold exceeded 18 million.

around 2 years in the KINECT group, and almost 6 years in the COMPUTER GAMES group (cf. Table 3). The shortest length of time involved in the KINECT group was connected with the fact that the games played have only been available since November 2010. Even though Kinect games have been rapidly gaining popularity[2], they are still a relatively "new" form of activity compared to dancing or computer games. Table 3 shows that computer games players quickly recognised this form of activity. This is to say, participants from the KINECT group have, on average, played computer games for 3 years; however, only occasionally (several minutes per week) over the last 2 years because their activity has been dominated by the Kinect game.

Measures

To verify the research hypotheses three methods were used: the Defence Style Questionnaire (DSQ; Andrews, Singh, & Bond, 1993), the Rosenberg Self-Esteem Scale (RSES; Łaguna, Lachowicz-Tabaczek, & Dzwonkowska, 2007), and the Bodily Self Representation Questionnaires (BSRQ; Mirucka, unpublished).

Defence Style Questionnaire

The DSQ was created by Andrews, Singh, and Bond (1993) to evaluate defence preferences displayed through the system of attitudes and beliefs. Following Vaillant's idea, Andrews et al. assumed that the defence mechanisms used to reduce threats varied in terms of maturity.

The DSQ consists of 40 questions that are rated by subjects according to the degree of truthfulness, rated on a 9-point scale (from 1 = *I definitely disagree*, to 9 = *I definitely agree*). The index of specific defence mechanisms is an average score of the two questions that relate to this mechanism. An indicator of each of the three levels is acquired by averaging the scores of all mechanisms related to that level. The minimum score is 1 and the maximum is 9.

The authors of the DSQ give the following psychometric qualities of the method. Reliability coefficients for specific levels: mature = 0.68, neurotic = 0.58, immature = 0.80. The test-retest reliability was also defined: mature mechanisms = 0.75, neurotic mechanisms = 0.78, and immature mechanisms = 0.85 (Andrews et al., 1993). Research conducted on a Polish population showed the split-half reliability as follows: 0.46, 0.6, 0.78. Furthermore, Cronbach's alpha is: 0.39, 0.56, and 0.73 (Bogutyn, 1995). The reliability of the test achieved in the conducted study is significantly higher (especially in the case of mature mechanisms) and takes the following values, respectively: 0.62 for Cronbach's alpha for the whole scale, and for particular subscales: mature mechanisms = 0.77, neurotic mechanisms = 0.78, immature mechanism = 0.69.

Rosenberg Self-Esteem Scale

The Rosenberg Self-Esteem Scale is a single-dimensional tool used for a general assessment of self-esteem, understood as a conscious attitude towards the self. It is made up of 10 diagnostic questions, which are marked on a 4-point level scale. This tool is characterised by a high degree of internal consistency; Cronbach's alpha score is between 0.81–0.83 depending on the age group tested. The stability ratio of this tool, defined by using the test-retest method, is 0.50 (1-year period). The theoretical accuracy of the scale was validated based on exploration and confirmation factor analysis (Łaguna, Lachowicz-Tabaczek, & Dzwonkowska, 2007). The reliability of the test achieved in the presented study is very high (Cronbach's alpha = 0.89).

Bodily Self Representation Questionnaires

Three scales that constitute the BSRQ were created to operationalise the variables of body schema, body image, and body sense. The fundamental differences between body schema and body image are based on differences between perception and motion. Body image is connected with having specific thoughts, while body schema is connected with movement capabilities and control over one's own body (cf. Gallagher, 2005). The third representation, known as body sense, is connected with the emotional relationship towards one's bodily self, and includes representations of physical needs and sensations, as well as the representation of emotional states (cf. Mirucka & Sakson-Obada, 2012).

All three scales are one-dimensional, with separate versions for men and women. The Body Schema Scale (BSS) and the Body Image Scale (BIS) consist of 6 items each (e.g., in the BSS "*I think that my movements are not coordinated*", in the BIS "*My appearance is normal.*"). The Body Sense Scale (BSeS) is far longer and contains 18 statements (e.g., *"I am ashamed of my body", "I even eat food I do not like."*) All items are statements that are rated on a 7-point scale ranging from *I totally disagree* to *I totally agree*. Each scale from the BSRQ has its own *a priori* key. The construction of the BSRQ was a multi-stage process completed according to the rules for creating psychological research tools based on advanced statistical procedures.

Table 3. Duration of activity: dancing, Kinect, and computer games

Group	duration (in years) of the activity		
	dancing	Kinect games	computer games
DANCE	**4.18**	0.01	0.55
KINECT	0	**1.83**	3.39
COMPUTERGAMES	0	0.09	**5.89**

The reliability of the scale was evaluated based on the results of a study of 744 people, aged 17 to 76, 466 of whom were women ($M = 32.24$, $SD = 12.28$) and 278 men ($M = 23.45$, $SD = 4.75$). The internal consistency (Cronbach's alpha) for all scales was satisfactory (Table 4).

Research procedure

For reasons of purposive sampling**,** the research was done in places which allowed for the availability of subjects who met the criteria of systematic involvement in a specific activity: 1) dancing, 2) playing games that require movement (Kinect type), and 3) computer games that do not require movement (educational and entertainment games). The members of the first group were selected from among people dancing in different dance studios; the third group was mostly composed of university students and students of technical faculties. The population representing the second group was the least accessible: the participants were selected from among Kinect enthusiasts found via the internet on fan forums. Having signed the informed consent form, all subjects participating in the study anonymously filled out a short survey containing some basic data (age, physical activities, time of involvement in those activities, etc.), and finally completed the whole set of questionnaires as described above in the Measures section. The research was conducted from June till the end of December, 2014.

The data obtained from this study were analysed using the statistical package IBM SPSS Statistics 21.

Results

A three-step analysis was conducted on the basis of the data collected from surveys and questionnaires. The first step was meant to verify the hypothesis related to the question of whether different forms of physical activity activate the body schema to different degrees. To do this, one-way ANOVA for unrelated groups was performed. Data analysis shows that the average results for body schema, body image and bodily experience vary significantly among the three selected groups (cf. Table 5). The highest degree of activation was reached in the DANCE group ($M = 31.23$; $SD = 3.27$); second place was taken by the KINECT group ($M= 25.10$; $SD = 5.83$), while the COMPUTER GAMES group ranked lowest ($M = 22.26$; $SD = 6.23$). A *post-hoc* multi-comparison Scheffe's procedure has revealed that the differences relating to the body schema are important among all groups ($p < .001$).

Figure 1 presents the representations of the bodily self across the three study groups. The DANCE group is characterised by the highest results in all these mental representations, not only in the body schema but also in body image and bodily experience. In this group, the

**Table 4. Cronbach's alpha for scales from the BSRQ**

CRONBACH'S ALPHA	SCALES	
	Version for women	Version for men
Body Schema Scale	0.70	0.76
Body Image Scale	0.85	0.89
Body Sense Scale	0.83	0.87

Table 5. Comparison of the results of bodily self representations for the three groups of participants: one-way ANOVA

Mental representations of Bodily Self	Mean and standard deviation			df	F	Significance level	Differences between groups
	DANCE (D)	KINECT (K)	COMPUTER (CG)				
Body Schema	**31.23** 3.27	**25.10** 5.83	**22.26** 6.23	2	23.37	P < 0.001	D-K D-CG K-CG
Body Image	**32.32** 4.26	**24.19** 7.62	**21.71** 8.10	2	20.22	P < 0.001	D-K D-CG
Body Sense	**30.87** 3.32	**26.61** 5.03	**24.28** 5.97	2	14.45	P < 0.001	D-K D-CG
Bodily Self	**94.42** 9.71	**75.90** 16.55	**68.25** 18.20	2	24.07	P < 0.001	D-K D-CG K-CG

average results differ significantly from the results in two other groups. Moreover, the average values of all three representations in the DANCE group are very similar to each other (body schema M = 31.23; body image M = 32.32; body sense M = 30.87), which may suggest a high degree of integration within the whole bodily self system that is far higher than in the KINECT and COMPUTER GAMES groups. In those groups, the differences between body image and body sense representations are significantly bigger, which in turn points to a significantly lower degree of coherence of the bodily self system.

Figure 1. The results of bodily self representations for the three groups of participants
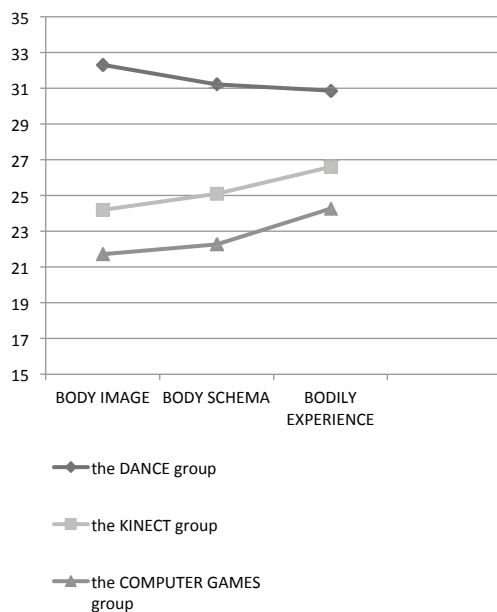
The second stage of this study was the verification of the hypothesis that there is an association between the level of body schema activation and self-esteem in late adolescence. The results obtained from a one-way analysis of variance for unrelated groups allow for the positive verification of this hypothesis. The study confirmed that the participants belonging to the DANCE group value themselves more positively (M = 34.74; SD = 4.37) than those who are involved in the Kinect type of activity (M = 30.32; SD = 3.63) or computer games, which require little (if any) motor involvement (M = 29.71; SD = 4.74). The differences are statistically significant ($F(2, 90)$ = 12.78; $p < .001$; η^2 = .22). However, in the KINECT and COMPUTER GAMES groups there was no significant difference in self-esteem, even though there were differences in the degree of body schema activation.

The last stage of the analysis of the data gathered was the verification of the hypothesis that the intensive activation of body schema in late adolescence that is manifested by systematic dancing activity is related to the activation of mostly mature defence mechanisms in a threat situation. The results displayed in Table 6 show that this hypothesis has been positively verified. The subjects from the DANCE group (i.e. those with the highest activation of body schema)

gained the highest scores on the scale of mature defence mechanisms (M = 6.94; SD = 1.44), and these results differ substantially from those in the COMPUTER GAMES group ($F(2, 90)$ = 5.70; $p < .01$; η^2 = .25). A statistically significant effect was also obtained in neurotic defence mechanisms ($F(2, 90)$ = 4.62; $p < .01$; η^2 = 0.09). This means that neurotic defence mechanisms are used more much more intensively in the DANCE group, with the highest activation of body schema (M = 5.03; SD = 1.70), compared to the KINECT group with average activation of body schema (M = 4.05; SD = 1.58), and as well to the COMPUTARE GAMES group, with the lowest activation of body schema (M = 3.97; SD = 1.26). The configuration of the scales of defence mechanisms was the same in all three groups: mature mechanisms are located at the high end of the scale, with neurotic mechanisms closer to the middle, and immature mechanisms situated at the lower end. Since it is in the DANCE group that all mature mechanisms (anticipation, humour, suppression and sublimation) and one neurotic mechanism (pseudo-altruism) are activated more intensely compared to the COMPUTER GAMES group, it may be argued that the differences in the body schema activation level seem to be significantly related to personality defence in late adolescence in terms of mature and neurotic defence mechanisms. In other words, an increase in the level of body schema activation is accompanied by a change in the way of overcoming anxiety (i.e. intensified activation of mature and neurotic defence mechanisms).

Although the three groups did not exhibit major differences in terms of immature personality defence styles, substantial differences were revealed in six (out of twelve) mechanisms, such as the following immature defence mechanisms: acting out ($F(2, 90)$ = 6.42; $p < .01$; η^2 = .12), displacement ($F(2, 90)$ = 4.49; $p < .01$; η^2 = .09), dissociation ($F(2, 90)$ = 6.93; $p < .05$; η^2 = .13), schizoid fantasy ($F2, 90$) = 3.28; $p < .05$; η^2 = .07), projection ($F(2, 90)$ = 6.12; $p < .01$; η^2 = .12), and rationalisation ($F(2, 90)$ = 13.09; $p < .001$; η^2 = .22). Two of these mechanisms – dissociation and rationalisation – are represented by the highest mean results in the DANCE group; these results are significantly higher than in the KINECT group (in the case of dissociation and rationalisation) and in the COMPUTER GAMES group (in the case of rationalisation).

Discussion

The aim of the present study was to examine the association between the body schema, the most primary representation of the bodily self, and two chosen aspects of reached maturity by youth in late adolescence: self-esteem and defence mechanisms. It was concluded that it is worthwhile to test the hypotheses concerning the importance of the body schema in some aspects of the subject's functioning at a critical time for the formation of identity. More precisely, the research aimed at the examining of the correspondences between the activation of the body schema along with the evaluation of the self (self-esteem) and the personality defence mechanisms.

The studies conducted positively verified the hypothesis that different forms of physical activities

Table 6. Comparison of the results from DSQ: differences between the three study groups measured by ANOVA variance analysis

Defence mechanisms	Mean standard deviation for groups			Significance of differences			
	DANCE (D)	KINECT (K)	COMPUTER (CG)	df	F	p	differences between groups
MATURE	**6.94** 1.44	**6.51** 1.14	**5.23** 1.20	2	15.24	0.001	D-CG K-CG
Anticipation	**5.22** 1.60	**5.18** 1.65	**3.90** 1.98	2	5.70	0.01	D-CG K-CG
Humour	**7.68** 1.52	**7.55** 1.48	**6.74** 1.63	2	3.33	0.05	D-CG
Suppression	**7.11** 1.90	**6.14** 1.70	**5.11** 1.68	2	10.01	0.001	D-K, D-CG K-CG
Sublimation	**7.75** 1.85	**7.18** 1.62	**5.16** 2.19	2	15.93	0.001	D-CG K-CG
NEUROTIC	**5.03** 1.70	**4.05** 1.56	**3.97** 1.26	2	4.62	0.01	D-K, D-CG
Pseudo-altruism	**5.97** 1.48	**4.43** 2.20	**4.79** 2.01	2	5.42	0.01	D-K, D-CG
Idealisation	**5.43** 2.18	**4.84** 2.41	**4.11** 2.18	2	2.67	ns	
Reaction formation	**4.76** 2.14	**3.97** 1.86	**3.87** 1.55	2	2.11	ns	
Undoing	**3.95** 2.27	**2.97** 1.57	**3.13** 1.67	2	2.48	ns	
IMMATURE	**3.58** 0.81	**3.64** 0.86	**3.87** 0.78	2	1.05	ns	
Acting out	**3.22** 2.04	**4.61** 2.37	**5.02** 1.71	2	6.42	0.01	D-K, D-CG
Denial	**2.84** 1.94	**2.08** 1.11	**2.64** 1.69	2	1.83	ns	
Devaluation	**4.10** 1.16	**3.63** 1.59	**3.43** 1.53	2	1.54	ns	
Displacement	**2.29** 1.30	**3.14** 1.86	**3.48** 1.63	2	4.49	0.01	D-K, D-CG
Dissociation	**3.93** 1.51	**2.56** 1.11	**3.27** 1.67	2	6.93	0.01	D-K
Schizoid Fantasy	**2.35** 1.71	**3.48** 2.47	**3.60** 2.07	2	3.28	0.05	D-K, D-CG
Isolation	**2.10** 1.51	**2.21** 1.49	**2.60** 1.60	2	0.90	ns	
Passive aggression	**2.66** 1.25	**3.27** 1.95	**3.43** 1.80	2	1.26	ns	
Projection	**1.52** 0.85	**2.42** 1.70	**3.11** 1.56	2	6.12	0.01	D-CG
Rationalisation	**7.21** 1.32	**5.61** 1.49	**5.27** 1.62	2	13.09	0.001	D-K, D-CG
Somatisation	**4.08** 1.80	**5.05** 1.62	**4.87** 3.23	2	2.91	ns	
Splitting	**3.27** 1.92	**3.37** 1.83	**3.95** 1.71	2	1.25	ns	

activate the body schema to different degrees. This means that the type of physical activity, depending on the involvement of fine and gross motor skills, is strongly related to the level of body schema activation, which in turn is reflected in the development of this representation and its position in the whole system of the bodily self.

It was proven that young people who undertake dancing, Kinect games or computer games in late adolescence vary in the level of their body schema activation. As anticipated, it was determined that dancing corresponded to the highest degree of body schema activation. As a result, people who danced regularly showed the highest level of functioning of the body schema, while the computer games players showed the lowest level. It seems cognitively intriguing that there are significant differences between the people who danced and those who played Kinect games. The latter were characterized by a significantly lower level of body activation, which might mean that the movement itself in the area of gross motor skills is not the only or sufficient factor in body schema activation. It is most likely that other representations of the bodily self, such as body image and body sense, also play an important role. In the case of the dancers, all the representations were activated, thus creating a coherent system of the bodily self. On the other hand, such activation did not take place among the players of computer games or the Kinect players (for whom the activation of the body image was replaced by the activation of the avatar image). This means that dancing as an art of movement, which integrates emotions, spontaneity, imagination, and a sense of rhythm, activates the body schema and other representations of the bodily self the most, by fostering their harmonious development. This can be achieved to a much smaller degree in the case of the Kinect game, particularly computer games which fail to involve movement. Earlier research (Sękowski & Jakubiec, 2007; Swami & Tovee, 2009) proved that dancing is beneficial for the level of body satisfaction, as well as helping to create a positive body image. We might conclude by saying that dancing can be used during late adolescence as an effective way of developing an integrated bodily self (along with a well-developed body schema, body image, and body sense), which in turn strengthens the whole system of the bodily self.

The study also made it possible to verify the hypothesis concerning the correlations between body schema and self-esteem during late adolescence. Those with the highest levels of functioning of the body schema, i.e. regularly dancing, had the highest self-esteem. On the other hand, computer games players had the lowest self-esteem. These results will become clearer if interpreted in the context of self-esteem formation and its functions. According to Lachowicz-Tabaczek and Śniecińska (2008), the shaping of self-esteem is a subject's adaptation mechanism. Owing to this mechanism, the subject's involvement is adjusted according to his/her abilities to act, which stem from emotional reactivity, activity, and strength. This means that self-esteem is rooted in the knowledge about energy-related possibilities to take action. The subjects, more so in the case of dancing than in the case of the Kinect game and computer games, have a chance to make full use of their abilities to act, by engaging

themselves completely. Thus, the subjects build their sense of worth, which is expressed in high self-esteem.

The study also aimed to examine the relationship between the level of body schema activation and the personality defence mechanisms. It was determined that in a threat situation the people from the DANCE group activate mature and neurotic defence mechanisms most intensively. Even though they do not differ much in terms of immature defence style, they activate certain immature mechanisms such as acting out, displacement, schizoid fantasy, and projection less often than teenagers from the other groups: KINECT and COMPUTER GAMES. The analysis of the arrangement of the defence mechanism scales in the research groups shows that along with the lowering of body schema activation and consistency of the bodily self, the intensity of mature and neurotic mechanisms also lowers, while the immature mechanisms simultaneously become intensified. In the COMPUTER GAMES group the configuration of the scales is much less varied than in the other groups. This might mean that an immature style of defence mechanisms is close to a neurotic one, although slightly, yet still lower than a mature one. These results indicate that the process of change in personality defences becomes more immature with the weakening of the body schema representation. We can assume that there is a border value of the lowering of the body schema activation, after passing which there is a major reconstruction of the personality defence system, i.e. the mature defence mechanisms stop being the dominating mechanisms and are replaced by the immature mechanisms. This assumption is confirmed by the results of a study conducted on women with bulimia nervosa (Mirucka, 2013). Among people with eating disorders of a bulimic type, along with the raising of interference of the bodily self (that is all representations, including body schema), there was an escalation of immature defence styles such as schizoid fantasy and splitting in particular. The immature defence mechanisms occupied the first, dominant position among the defence styles, followed by the neurotic mechanisms, while the mature defence mechanisms were in the final position.

The results pertaining to the intensification of immature defence mechanisms such as dissociation and rationalisation seem intriguing and are in need of further explanation. In the DANCE group they were significantly higher than in the other two groups. According to Freud, as well as some contemporary psychoanalysts, the rationalisation mechanism appears as late as in adolescence, and therefore it is defined as "adolescent age defence". This may mean that young people use this mechanism involuntarily and unconsciously to secure the integration of the self, as well as to defend their self-esteem. However, in view of some other results in this study (the domination of mature and neurotic mechanisms in the group with the highest body schema activation), the question that arises is whether the two mechanisms – rationalisation and dissociation – were correctly classified by Bond (Andrews, Singh, & Bond, 1993) as immature ones. It is possible that Meissner's classification (1989: after Kokoszka 1997) is more accurate. This is to say that the two above-mentioned mechanisms – in his classification of thirty-two defence mechanisms in groups according to the developmental criteria

– were classified as neurotic and not immature ones. The results of the present study seem more coherent if we take that change in classification into account. But even if we accept Bond's classification, then rationalisation and dissociation (quite intensively activated in the DANCE group) do not have to constitute an immature personality organisation in late adolescence. As long as mature and neurotic defence mechanisms dominate, the reaching of maturity in late adolescence by youths with a high degree of activation of body schema is not threatened. Instead, it is reflected, among other things, in a positive attitude towards the self, expressed by the high self-esteem of youths who dance regularly. Recapitulating, intensive body schema activation in late adolescence, especially through dancing, is of vital importance for the strengthening of positive self-evaluation, as well as for developing mature personality defence mechanisms. Therefore, it is vital for reaching maturity.

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