



Understanding factors behind the effectiveness of personal identification: Revolution – a new technique of creative problem solving



Jarosław Orzechowski*, Ewa Kruchowska, Aleksandra Gruszka, Błażej Szymura

Institute of Psychology, Jagiellonian University, Poland

ARTICLE INFO

Article history:

Received 19 February 2016

Received in revised form 9 August 2016

Accepted 5 December 2016

Available online 10 December 2016

Keywords:

Creativity

Problem solving

Metaphor

Personal identification

ABSTRACT

Although it is widely believed that inducing a change in mental perspective through personal identification with an object facilitates problem solving, empirical evidence that supports this thesis is limited. The present study aimed at recognition of factors determining the effectiveness of personal identification by verifying the efficiency of a new technique of creative problem solving called Revolution. Forty-six subjects participating in the naturalistic study were randomly assigned to five experimental groups testing several versions of Revolution. The following factors were manipulated: personal identification (presence versus lack of identification), problem type (abstract versus specific) and time lag between the preparation stage (preparing the project) and the execution stage. Solutions generated by different groups were evaluated by a team of eight competent judges using the Creative Product Semantic Scale. There was no difference in the overall quality of the solutions when problem type variable was under consideration. Surprisingly, identification appeared to have a negative impact on product creativity (as evaluated by the judges). Detailed analyses revealed that the negative influence of personal identification was limited to specific task conditions, implying that it can be neutralized by separating the preparation from execution stage. The implications of the present results are discussed.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

Problem-solving and creative thinking techniques have been repeatedly shown as promoting creative solutions in many settings (Scott, Leritz, & Mumford, 2004a; Scott, Leritz, & Mumford, 2004b; Tsai, 2013), although not unequivocally (Laakso & Liikkanen, 2012). They have been defined as ‘a plausibly effective prescription expressing more than common knowledge’ (Smith, 1998, p. 109) that are based on heuristics, i.e., standard sets of instructions about how to solve a problem. As opposed to algorithms, creative problem solving techniques can be applied to broader classes of problems. Although they do not guarantee that an effective solution will be obtained, nevertheless, they facilitate achieving satisfactory and creative outcomes. The aim of this study was to determine the effectiveness of a new problem-solving technique, which we have called *Revolution*. The technique is based on the assumption that inducing a change in mental perspective via personal identification with an object leads to unique responses.

* Corresponding author.

E-mail address: j.orzechowski@uj.edu.pl (J. Orzechowski).

There are numerous techniques that can be used to increase the probability of success in creative problem solving. Upon review of about 170 methods described in the literature, Smith (1998) has suggested that circa 70 of them are particularly powerful. In order to be effective, a technique must affect user's thinking. It does so through "active ingredients", i.e. procedures producing desired mental shift (e.g., by employing a specific strategy for habit-breaking, problem analysis, or search for additional information, etc.). According to Smith (1998) most of the techniques are in fact based on a limited range of "tricks" or "active ingredients". The author identified fifty idea-generation devices of three types: strategies, tactics, and enablers. The most numerous and significant tools are strategies defined as active means for generating ideas, that refer to specific mental operations (e.g., analytical strategy, search strategy or imagination based strategy). Tactics work within strategies as stimulatory tools (e.g., elaboration tactic that requires a problem solver to mentally enrich the problem situation). Finally, enablers are passive means of promoting idea generation (e.g., motivational enablers, anti-inhibition enablers). Rather than directly inspiring creative output, enablers set up conditions within which ideas are more likely to appear. For example, Nęcka (1994) describes six principles, including: generating many diverse solutions, separating generation of ideas from their evaluation, having fun and working in friendly atmosphere, using incompetence and irrational thinking in order to avoid rigidity, being immersed in the process (being mentally present now and here).

Revolution is a new problem solving technique developed by our team on the basis of extensive experience of moderating creative thinking trainings and problem solving sessions. It is applicable to a new product/process development or improvement and refinement, i.e., it can be used in any case, when a new creation is meant to be based on the pre-existing elements that need to be combined in a new, functional and creative tangible object or idea. According to classification offered by Smith (1998), Revolution utilises two strategies: habit-breaking and imagination-based. Habit-breaking is achieved here via making the solvers think about the problem from the viewpoint of the objects with which they are identified. This trick induces a change in the thinker's mental perspective. Moreover, personal identification, which requires problem solvers to imaginatively become a non-human part of the problem, represents an imagination-based strategy. A good example of this strategy is Personal Analogy technique described by Higgins (1994), as well as Nęcka, Orzechowski, Gruszka, and Szymura (2005).

In terms of the theoretical assumptions, the procedure of identification ties together many mental activities known to promote creative thinking. It prompts metaphor comprehension (Miller, 1996) and promotes object redefinition by means of abstract thinking and deduction (Nęcka, 1987). These operations are considered as core processes participating in the creative process (Nęcka, 1987; Mumford, Mobley, Reiter-Palmon, Uhlman, & Doares, 1991). Many techniques used for stimulating creative thinking are based on these operations (Nęcka et al., 2005). Moreover, the procedure of identification induces joyful atmosphere and many lines of evidence suggest a link between positive mood and creativity. Indeed, positive mood facilitates divergent thinking, in particular, fluency and flexibility of thinking (Grawitch, Munz, & Kramer, 2003), openness to novel information (Isen, 2001; Isen & Labroo, 2003). It also stimulates intrinsic motivation (Isen & Reeve, 2005) that leads to enhanced task engagement and heightened originality and utility of generated solutions (Amabile, 1985; Tokarz, 2005).

Although perspective-changing techniques are believed to be particularly useful in solving challenging problems, the empirical evidence is limited. Butler and Kline (1998) have examined three types of heuristics: brainstorming, the hierarchical technique, and changing perspectives to determine which produced the highest number of solutions, the best solutions, and the most creative solutions. Results indicate that the changing perspectives technique was relatively less helpful in terms of facilitating fluency of thinking, and moderately useful in terms of generating solutions perceived as best or most creative.

The present study aimed at investigating further the specific conditions under which identification is most effective by testing the effectiveness of several versions of Revolution. Below we firstly present the procedure of Revolution, followed by the specific hypothesis tested in this study, as well as their rationale.

1.1. Procedure of revolution

Revolution involves three separate stages: personal identification, creative combinatorics and idea implementation.

At the first stage of the technique, i.e., *Personal Identification*, each participant (working individually) is required to personally identify with an object, i.e. to imagine becoming a non-human item belonging to a given category (the objects may belong to any category, the only requirement being that all group members work with the same category). Particular categories chosen here depend on the nature of the problem to be solved (they are elements of the problem) and they are pre-specified beforehand by the moderator.

In order to choose their particular target of identification, each participant draws a lot with the name of the objects. Afterwards, the moderator introduces the context of Revolution by presenting the first instruction (see Appendix A), followed by the second instruction called 'Revolutionary Manifestos', which aims at guiding identification with the target object (see Appendix B). The second instruction takes form of a revolutionary proclamation issued by the item (each particular object has its own 'Manifesto').

The "Manifestos" are meant to stimulate and facilitate the identification process. They consist of two parts. The first part of the instruction draws the participant's attention towards atypical object characteristics, as perceived 'from an object perspective' by asking them to *'display multiple possibilities of applications'* of the target object. Following this task, the second part of the 'Manifesto' requires the participant to propose novel uses (applications) for the object (*"I could become something more than a (...) of which I have had enough. Clearly. I can also do/be. . ."*).

Table 1
Experimental design.

The abstract condition Without identification		With identification		–	
For women	For men	For women	For men		
The concrete condition Without identification		With identification		With identification – the preparation stage and the implementation stage separated	
For women	For men	For women	For men	For women	For men

The 'Manifestos' are written in an amusing style in order to induce cheerful, relaxed and friendly atmosphere. Thus, it is assumed that the 'Manifestos' will improve the quality of the resulting problem solutions by activating the core creative operations (metaphor comprehension, abstraction and deduction) and by stimulating extracognitive enablers (e.g. the playful mood).

Once the 'Manifestos' forms are completed by the participants, the identification phase is over. It is stressed by the formal procedure of calling the identification off.¹

Following identification, in the second stage of Revolution – *Creative Combinatorics* – the participants are grouped into small teams.² At this stage, their task is to produce an original creation by combining together the items that were previously subject of identification into a new idea of a product. The product is supposed to be novel, original, functional and elegant.

Finally, at the *Idea Implementation* stage the task of the teams is to implement one product idea generated in the previous phase. Depending on the variant of the task, idea implementation could amount to construction of a prototype of a product with the use of available materials. Alternatively it could amount to elaboration of a detailed concept of a product, when construction of a prototype is unnecessary or impossible (e.g. when the task is abstract).

1.2. Hypothesis and study design

For the purpose of the current study, five modifications of the original procedure of Revolution were devised to incorporate the experimental manipulations described below. The overall design of the study is summarised in Table 1.

The first manipulation was related to the factor of identification. In the **identification** condition, the participants were firstly familiarised by the trainer with the procedure of identification, and then completed the 'Manifestos'. Each participant drew a lot with the name of the discipline or the piece of clothing (depending on the abstract/concrete condition, see below) in order to be assigned the particular condition. In the condition **without identification**, the stage of identification was omitted, and the participants began their work right from the solution generation phase (i.e., creative combinatorics). In other words, in this condition no identifications were used.

The second manipulation was related to the type of material used: **abstract** versus **concrete**. In the abstract object condition the participants were required to design a new scientific discipline or approach by combining four distinct disciplines: theatre studies, astronomy, economics and medicine. In contrast, in the concrete object condition, the task was to create a new functional artefact, but not a piece of clothing, by combining leggings, a glove, trousers and a belt.

In both abstract and concrete conditions the same constraints on the desired solutions were introduced. The product was supposed to be novel, original, useful and elegant. In the abstract condition, the new scientific discipline was supposed to be a mere combination of the four suggested disciplines, whilst in the concrete object condition the newly generated artifact was supposed to be a combination of the four objects provided, with the possibility of their transformation with a use of scissors, a sewing needle, thread, and glue. In other words, there was no possibility of using the provided materials selectively (e.g., only one of them), or using additional concepts/objects. These limitations were introduced to make sure that the solutions obtained in all experimental groups would be comparable in the terms of material used to enable further between-group comparisons.

Necka (1987) claims that working with abstraction – due to the fact that there is no “reality bending” – may result in more creative, unusual solutions. However, it seems that the identification with a real object allows one to look at it from a different perspective, which provides an opportunity for object redefinition. In result, it activates different contextual cues, which, in turn, activate diverse memories and lessen functional fixedness (Butler & Kline, 1998). In this way the object gains new (sometimes unrealistic) capabilities, which facilitates its creative solution. This mechanism does not seem to work in the case of abstract objects. Consequently, benefits stemming from identification can be superior in case of concrete object, as compared to abstract concepts. Moreover, concrete objects are associated with relevant gestures, which allow direct

¹ Calling off the identification followed the procedure of “uncasting the spell” consisting of repeating by each participant of the formula: “I am not [...] anymore, my name is [...], where the first set of [...] corresponds to the name of the previously used item or discipline and the second set of [...] to the participant's proper name (Necka et al., 2005). The “uncasting of the spell” was reinforced by the moderator. (Appendix C).

² The size of the teams depends on the overall number of participants and on the number of objects used in Revolution. For example, if the working group is made up of 12 people, we suggest the use of 4 items and the division into three teams, with each team working on one item.

expression of spatial properties of an object without a translation to verbal codes. Findings on embodied cognition suggest that therefore gestures make working memory resources more available for problem solving (Hostetter & Alibali, 2008).

The third experimental manipulation pertained to the separation of the preparation and idea implementation stages of problem solving. In one of the groups working under identification condition, the participants were required to firstly generate many possible solutions, and then to choose one of them as the final product. It was followed by the **implementation** stage. The aim of this manipulation was to examine whether the separation of the two stages would lead to the higher quality of the generated products.

A strict separation of the generative and implementation phases – as a time lag between generating ideas and their physical ‘making’ – was possible only in the concrete condition. Such manipulation was not possible in the abstract condition, because the task was purely conceptual, and the groups were not expected to ‘make’ an object since both generation and elaboration of the solutions was mental.

In terms of the rationale for this manipulation, it is supported by two findings well known in the literature. First of all, dividing of problem solving process into two stages – ideas generation and their evaluation – has proved to be effective, as in the case of Brainstorming designed in the late 1940s by Osborn (1979). Secondly, the time lag between generating and implementing ideas may provide time additional for incubation. It has been shown that incubation can aid problem solving (Smith, 1995; Smith & Blankenship, 1991; Yaniv & Meyer, 1987).

Finally, regardless of the three manipulations described above, each experimental group was further divided into two subgroups in order to assign to them specific tasks, and because of that another manipulation was introduced. This manipulation was not driven by any theoretical expectation, but was logistic in nature. Thus, regardless of all other experimental conditions, one subgroup was always working on a product suitable for women, whilst the other subgroup was preparing a male-suitable version of the product. Accordingly, teams in the abstract condition were required to work on a scientific discipline aimed at solving problems of men or women. Similarly, in concrete conditions, a new product was expected to be suitable either for men or for women.

In sum, a combination of all the experimental manipulations described above resulted in the following experimental design. There were two versions of abstract ‘Revolution’: (i) without identification (with a solution suitable either for men or for women) (ii) with identification (with a solution suitable either for men or for women). Furthermore, there were three concrete version of ‘Revolution’: (iii) without identification (with a product suitable either for men or for women) (iv) with identification (with a product suitable either for men or for women), and finally, with identification and preparation phase (with a product suitable either for men or for women).

We predicted a positive effect of personal identification on problem solving (as compared to lack of identification). We also expected that identifying with a concrete object/item would lead to more creative solutions than identifying with abstract concepts. Finally, we also assumed a positive effect of separation between the preparation and implementation phases.

2. Method

2.1. Subjects

46 fourth and fifth year students (including 38 women) from the Institute of Psychology at the University of Social Sciences and Humanities in Warsaw volunteered to participate in the study. Their mean age was 26.66 (SD = 5.99). Prior to the study, all subjects took part in a 50-h university course on creative thinking and problem solving. The course was aimed at developing skills and abilities in the area of creative thinking and at preparing the students for the role of moderators of inventive sessions. Permission for the study was obtained from the local research ethics committee and all subjects consented to the participation.

The research was conducted in the spring of 2007. The course was run in five groups of 10–12 participants led by experienced trainers (and co-trainers) according to the procedure developed by Necka and colleagues (Necka et al., 2005). The participants were assigned to a workshop group on the basis of their choices at the beginning of the academic year. Before the study, the trainers and the co-trainers who run the study received a detailed introduction and instructions on Revolution. Neither the trainers/co-trainers nor the participants were informed about the specific design of the study and manipulations introduced in all other groups.

2.2. Procedure

Before running Revolution, in the first step each experimental group participated in an exercise ‘True or false’ (Rojewska, 2000). The task was aimed at introducing a relaxed and cheerful atmosphere, similar in all groups. Then the specific procedure for each group was governed by the experimental design, as summarised in Table 2 (in Table 2 the ‘male/female solution’ factor described above is omitted for the purpose of overall clarity).

Once all stages of Revolution were completed, the groups presented their solutions to all other participants. The presentations were run in a random order and were video-recorded for the purpose of assessment by competent judges.

Table 2

The procedure of the study for each experimental group.

Group condition: abstract without identification	Group condition: abstract with identification	Group condition: concrete without identification	Group condition: concrete with identification	Group condition: concrete with identification and the preparation stage and the implementation stage separated
1. Splitting of the group into four sub-groups representing four scientific disciplines	1. Splitting of the group into four sub-groups representing four scientific disciplines 2. Instruction aimed at stimulating identification (stage I) 3. The participants are filling 'Revolution Manifesto' 4. Presentation of 'Manifesto' to the other members of the group 5. Instruction aiming at stimulating combinatorics (stage II)	1. Splitting of the group into four sub-groups representing four pieces of clothing	1. Splitting of the group into four sub-groups representing four pieces of clothing 2. Instruction aimed at stimulating identification (stage I) 3. The participants are filling 'Revolution Manifesto' 4. Presentation of 'Manifesto' to the other members of the group 5. Instruction aiming at stimulating combinatorics (stage II)	1. Splitting of the group into four sub-groups representing four pieces of clothing 2. Instruction aimed at stimulating identification (stage I) 3. The participants are filling 'Revolution Manifesto' 4. Presentation of 'Manifesto' to the other members of the group 5. Instruction aiming at stimulating combinatorics (stage II)
2. Splitting the group into two sub-groups (at least one discipline in each)	6. Splitting the group into two sub-groups (at least one discipline in each) 7. Exiting of identification	2. Splitting the group into two sub-groups (at least one piece of clothing in each)	6. Splitting the group into two sub-groups (at least one piece of clothing in each) 7. Exiting of identification	6. Splitting the group into two sub-groups (at least one piece of clothing in each) 7. Exiting of identification
3. Presentation of the task	8. Presentation of the task	3. Presentation of the task	8. Presentation of the task	8. Presentation of the task 9. Preparation. A group is working on the project.
4. Product implementation (stage III)	9. Product implementation (stage III)	4. Product implementation (stage III)	9. Product implementation (stage III)	10. Product implementation (stage III)

2.3. Product evaluation

The resultant products were evaluated by eight competent judges (Amabile, 1983) – experts in the area of psychology of creativity. Since the overall number of the products in the study was fairly low (10 products, as resulting from the experimental design), a fairly high number of judges was motivated by the need of keeping the reliability of measurement as high as possible. Four of the judges were also participating in the study as trainers, whilst the remaining five judges did not participate in the study as group leaders. The assessment of the products was done with the Creative Product Semantic Scale (CPSS) (Besemer & O'Quin, 1999; O'Quin & Besemer, 2006).

The judges independently rated all ten products except for the products created by their own groups.³ The procedure of evaluation allowed the judges to familiarise themselves with all experimental conditions before making the ratings. The judges were firstly asked to watch all the final presentations of the group products (ten presentations). Then the judges were presented with all the instructions of Revolution (i.e., instructions provided to the participants in the course of problem solving). Finally, after the second viewing of the product presentations, the judges rated the products. They were explicitly instructed to focus on and rate the qualities of the products rather than the qualities of the presentations themselves.

The CPSS used in this study was developed by (Besemer & O'Quin, 1999; O'Quin & Besemer, 1989, 2006). It was translated for the purpose of this study.⁴ The scale is based on an empirically tested theoretical model, which conceptualizes three dimensions of product attributes: Novelty, Resolution, as well as Elaboration and Synthesis. Accordingly, the CPSS consists of 71 items grouped into 11 subscales, which, in turn, represent three theoretical attributes of a product.

Novelty refers to the newness of the product. It consists of three subscales, i.e., Original (unusual or infrequently seen), Transformational (revolutionary), and Germinal (suggestive of further creative products).

Resolution, which refers to the degree to which the product meets the criteria of the desired solution, also consists of three subscales: Valuable (seen worthy by users because it fill their needs), Logical (seen as following the rules of the discipline), and Useful (possessing practical applications).

Finally, Elaboration and Synthesis include five subscales: Structured (well organized), Elegant (expressed in a refined way), Complex vs. Simple (containing many elements at one or more levels or, in contrast, a simple, basic structure), Understandable (presented in a communicative manner), and Well-Crafted (develop it to the highest possible level within given constraints).

³ It is very important in regard to the *t*-test used in the statistical analysis, in which only ratings of the judges assessing the comparable experimental conditions were included (hence, *df* vary, depending on a particular analysis – see 'Results' section).

⁴ We express our gratitude to Agnieszka Krupa, MA, for her help with the CPSS English to Polish translation.

The CPSS employs the semantic differential scale. Accordingly, the judges were asked to choose their preferred position on a 7-point scale, where both ends of the scale represented two bipolar adjectives (for example: 'Original-Ordinary'), and four equals to the neutral judgement.⁵

3. Results

The descriptive statistics, *t*-test, and W-Kendall test from the Statistica package were used for the analysis.

To evaluate the degree of agreement of expert judgements inter-rater reliability was assessed with W-Kendall test. Kendall's W indicator calculated for whole study equalled 0.743 ($\text{Chi}^2(10) = 59.4, p < 0.001$) and can be interpreted as high.

As to the first hypothesis concerning positive influence of identification, the results indicated that the experts' ratings of the products created under identification condition, compared to control condition, were lower for all assessed criteria, i.e., novelty of the solution ($M = 3.57$ (Identification; I) versus $M = 4.48$ (Without Identification; WI) ($t(5) = 4.55, p < 0.007$)), the quality of solutions ($M = 3.52$ (I) versus $M = 4.20$ (WI) ($t(5) = 3.27, p < 0.03$)), and to their refinement and synthesis ($M = 4.00$ (I) and $M = 4.64$ (WI) ($t(5) = 3.86, p < 0.02$)). It suggests that the positive influence of identification on problem solving, as compared to lack of identification, was not confirmed.

However, more detailed analyses of the effects of identification on the final products, including type of material used, revealed that higher ratings of products created without identification occurred only in the condition of concrete object. Thus, in the concrete object condition, the products were rated as follows: the novelty of solutions: $M = 3.30$ (I), and $M = 4.30$ (WI) ($t(6) = 2.40, p < 0.053$), the quality of solutions: $M = 3.37$ (I) and $M = 4.64$ (WI) ($t(6) = 5.88, p < 0.002$), their refinement and synthesis: $M = 3.84$ (I) and $M = 4.99$ (WI) ($t(6) = 5.37, p < 0.002$). As to the abstract condition, the identification did not influence the ratings of the products.

Furthermore, the current results do not confirm the second hypothesis. Differences between ratings of the products obtained under the conditions of concrete versus abstract material for all the subscales of CPSS were too small for the *t*-test to recognize them as statistically significant.

However, the results of the current study confirmed the third hypothesis. The products created with identification when stages of preparation and execution were separated, compared to the products created without separating these stages, were rated higher in all three subscales of CPSS. Namely, the novelty: $M = 4.95$ in the condition of identification and separation of the stages of preparation and execution (IS) and $M = 3.49$ in the condition of identification and the lack of separation of the two stages (ILS) ($t(6) = 2.29, p < 0.062$); the quality of solutions: $M = 4.34$ (IS) and $M = 3.46$ (ILS) ($t(6) = 3.35, p < 0.02$); refinement and synthesis: $M = 4.78$ (IS) and $M = 4.05$ (ILS) ($t(6) = 2.98, p < 0.025$). Descriptive statistics for all the conditions of Revolution are shown in [Table 3](#).

4. Discussion

The present results showing negative influence of personal identification on the ratings of products can be considered surprising. Identification leads to metaphorical thinking, which is regarded both as one of the key creative skills, and extremely refined end-product of the creative process (Lubart & Getz, 1997; Mial, 1987; Miller, 1996; Nęcka et al., 2005). Many methods of creative problem solving used routinely are based on personal identification (Higgins, 1994; Nęcka et al., 2005; Proctor, 2010). Thus, the positive effect of identification on creative thinking was expected.

However, identification was "harmful" to the creative quality of products only in the concrete condition, and not in the abstract condition. There are several possible explanations of this result.

The first explanation relates to the relationship between the concrete vs abstract nature of the object explored in the creative process and the scope of attention. Presumably, in the concrete condition – when the object of identification was easy to imagine and even physically present at the later stage of the problem solving, attention may have been easily drawn and narrowed to the perceptual details of the target object. By contrast, abstract concepts are not associated with strong perceptual cues, and thus, they may not have limited the scope of attention. According to Friedman and colleagues (Friedman, Fishbach, Förster, & Werth, 2003) situationally narrowed or broadened scope of perceptual attention correspondingly constraints or expands the focus of conceptual attention within the semantic network. It leads to respective diminishment or improvement of creativity, because the scope of attention affects memory retrieval processes. The narrow scope of perceptual attention (and, hence, conceptual attention) enhances recall of recently encoded material by inhibiting the activation of competitor items. Thus, this mechanism may have led to the type of fixation on recently developed ideas in the case of the concrete object condition in the present study. By contrast, the broadened scope of perceptual and conceptual attention diminishes interference from highly accessible items enabling retrieval of less recently encoded or more weakly associated concepts (Friedman et al., 2003). This latter situation relates to the abstract condition of the present study.

⁵ Previous results obtained by (O'Quin & Besemer, 1989) indicate that reliability of the eleven subscales, as measured by Alpha Cronbach, is in between 0.65–0.85. However, an analysis of dataset stemming from several studies did not replicate the theoretical 3-factors structure (Besemer and Treffinger, 1981). Two factors: Novelty and Resolution explained 64%–71% of variance (in separate studies). The Elaboration and Synthesis factors were the least reliable. Quite often the authors were unable to replicate it in their analysis, whilst its subscales exhibited correspondence to Resolution. However, it did not lead the authors to revise the scale. Thus, the CPSS was used here in the original form.

Table 3
Means and standard deviations of experts judgement for all the conditions of Revolution.

CPSS subscale	Condition									
	Concrete without identification		Concrete with identification		Abstract without identification		Abstract with identification		Concrete with identification and the preparation stage and the implementation stage separated	
	M	SD	M	SD	M	SD	M	SD	M	SD
Novelty	4.16	0.62	4.02	0.29	3.78	0.18	3.82	0.28	3.89	0.18
Original	4.48	1.22	4.00	0.29	4.20	0.47	3.90	0.44	4.25	0.31
Transformational	4.30	0.93	4.18	0.62	3.83	0.44	3.90	0.33	3.80	0.41
Germinal	3.70	0.47	3.88	0.34	3.31	0.43	3.65	0.46	3.63	0.39
Resolution	3.45	0.23	3.53	0.21	3.83	0.47	4.03	0.20	3.54	0.17
Valuable	3.80	0.25	3.60	0.29	3.53	0.41	3.58	0.52	3.78	0.36
Logical	3.05	0.47	3.85	0.71	4.15	1.03	4.18	0.75	3.33	0.33
Useful	3.50	0.48	3.15	0.32	3.83	0.61	4.33	0.64	3.53	0.60
Elaboration and Synthesis	3.84	0.14	3.79	0.16	3.87	0.21	3.93	0.26	3.70	0.14
Structured	4.45	0.34	3.88	0.40	3.75	0.35	3.90	0.37	4.23	0.33
Elegant	3.43	0.42	3.65	0.50	4.13	0.46	4.25	0.70	3.48	0.27
Complex vs. Simple	4.73	0.72	4.00	0.40	3.88	1.26	3.70	0.77	4.05	0.63
Understandable	3.45	0.17	3.85	0.48	3.88	0.33	3.95	0.66	3.55	0.25
Well-Crafted	3.13	0.43	3.58	0.35	3.70	0.40	3.85	0.41	3.20	0.41

Explanations: M – mean score, SD – standard deviation.

Further explanations of the negative influence of personal identification on creative problem solving observed in this study are related to the context of the present study. The first explanation pertains to the specific nature of the identification process. It can be speculated that identification stimulated by 'Manifestos' instruction turned out to be so strong that ordinary "spell-breaking" was not enough, and the participants engrossed in the identification had difficulties with transition to the next stage of thinking. These difficulties could take the form of resistance to "being" the target of manipulation, sometimes quite "drastic" (such as cutting or getting rid of components in the concrete condition). This speculation is, again, consistent with the results showing that negative influence of identification was revealed only in the concrete condition (and did not occur in the abstract condition) – that is, in the case of manual work with pieces of clothing.

Furthermore, another possible reason for the negative influence of identification in the concrete condition may be a paternal affect for the identification effects. The negative influence of identification could be explained by the participants' reluctance to abandon (or underuse) the solutions, developed by them individually in their declarations, during the next stage of work in a group (combinatorics). Such a situation could generate the participants' resistance and reluctance to their further creative work on the problem.

Finally, one can also try to explain these results in the light of the outcomes of verification of the third hypothesis. In fact, the identification carried out with the use of 'Manifestos' declarations lowered the ratings of the resultant products in all three scales of CPSS. However, separation of the identification and execution stages (tested only in the concrete condition) led to higher ratings of the products. Separation of the two stages seems to bring about two major benefits. First, it creates a time gap between identification and the use of its effects. The time gained through the separation may have been used for conceptual development of alternative product designs based on to the process of incubation. In other words, the time gap allowed incubation, which may have released fixation developed during initial solution attempts (Smith, 1995; Smith & Blankenship, 1991; Yaniv & Meyer, 1987). Thus, such conduct increases the probability of generating and selecting the most creative solution.

It can be further speculated that the time gap enables the participants to fully leave the identification stage and to distance themselves from the object they identified with a moment earlier. In this way, it becomes possible to modify it without any scruples, or even to destroy the object of identification at the stage of combinatorics (the issue indicated above). Second, creation of a temporal distance could also weaken the paternal affection for ideas previously generated in declarations, allowing for creative focusing on combinatorial work on a problem, even if individual ideas have not been accepted.

Finally, the results of the current study can be interpreted in the broader context in which the study was conducted. The participant of the study were the students who beforehand underwent the creative thinking training involving 60 h of exercises of all sorts. According to (Ulger, 2016), creative thinking training may not necessary lead to enhanced capacity for problem solving. The reason is that training situation may lead the participants to adoption of a specific mind set or attitude – called by the author 'open-minded' set. This attitude involves a belief that problem solving situation is an open-ended situation and does not require a real completion in the form of one, final solution that needs to fulfil the pre-defined criteria. Most likely, at least some of our participants were under the influence of attitude.

Considering the foregoing interpretations, it would be worth making such a modification to Revolution that would not so much as minimize the negative influence of the above mentioned factors on identification, but bring out a positive

potential inherent in making metaphors. For this purpose, one can try and structure the “intermediate” stage, that is, the one occurring between preparation and execution. At the stage of group ideas generation that followed identification, the participants sometimes spontaneously used the creative techniques learned earlier. This may reflect a need for structuring and transfer of information obtained as a result of identification before their final use during problem solving in the group. The results of the study described in this paper testify to the fact that this stage is a crucial link in Revolution technique. Since the mere separation of the preparation and execution stages had a positive influence on the quality of products, then enriching the technique with a link facilitating a structured transition between the two stages should only enhance this effect. The positive influence of implementation planning, i.e., of structuring the results of conceptual creative activities before their realization, was discussed in other studies (Osburn & Mumford, 2006). This effect is also apparent for problem construction (Vernon & Hocking, 2016). Such conduct increases the probability of completing the creative process with success. However, the supposition that such an operation would improve the effectiveness of Revolution technique requires further studies.

The sample problem used in the presented version of the Revolution technique has a training function. It has been chosen to be attractive to the participants of the study and to stimulate their creativity (Davies et al., 2013). Practical applications of this technique concern a wide range of complex problems. For example, in the problem of repairing or improving communication within an organization one needs to take into account its many levels and forms, and that makes the problem very difficult. If in the identification stage we look from different perspectives at the most important aspects of communication (i.e. instruments and forms of communication), and then we examine various possibilities of combining these unique perspectives, we stand a chance of developing a new and valuable solution, which is additionally systemic. We can imagine a similar procedure applied to the problem of creating or improving products (e.g. a car or a smartphone), processes (e.g. customer service or handling complaints), and even to their combination (e.g. generating new ideas for banking or telecommunication services).

Thus, in real-life applications, this method allows tackling very complex problems, and it combines the advantages of identification (looking from a different perspective at the problem components) with those of combinatorics (integrating these various perspectives in order to generate solutions). The important thing is that the resultant solutions, even in the case of problems that are very complex, to the point of being not uniform, have a chance to be consistent. This is due to the fact that the final solutions may integrate all the combined perspectives into one idea. Tackling complex problems usually requires decomposing them into subproblems that are solved independently. Thus, there is a problem of their integration that can sometimes be difficult or even impossible. In the Revolution technique such integration also must be done, but the applied procedure naturally enforces this integration, and the ideas, which are impossible to integrate “die naturally.”

The current study acknowledges several limitations. Revolution is a new technique for creative problem solving, therefore the examination of its effectiveness as well as the attempts to increase its efficiency through modifications and testing are only in an initial phase and could be regarded as pilot studies. Because of the small number of compared products, it is difficult to consider the current results unambiguous, but it is certainly possible to indicate the directions of potential modifications and improvements. Moreover, the obtained results suggest the necessity to pose questions about the conditions of effectiveness of identification as such, which is, after all, used also in other techniques for creative problem solving. This study, testing the effectiveness of Revolution technique in a group, contributes to the experimentally neglected but very important field of group psychology of creativity (Kurtzberg & Amabile, 2001). We hope that our study will not only arouse our readers' interest in the technique itself, but also will become a source of inspiration for further, still extremely rare studies on the practical management of the creative process at a group level.

Appendix A.

Instruction aimed at stimulating identification – Stage I of Revolution. Concrete object version. The instructions for the abstract version are similar with the exception that the frustrated items are not types of garments but science disciplines.

Herewith you have discovered your secret identity. For the forthcoming few moments, you will become the very item that you are holding in your arms right now. Look at the items. Most of us came across them more than once in our lives. Today, you will observe the world through their eyes, resentful eyes of objects that frequently expected SOMETHING ELSE on your side. While suffocating for years is cramped wardrobes being thrown dispassionately onto shabby shelves. Spending their lives in numb waiting and trying to muster a glimmer of hope whenever you took them in your hands. These clothes continually THOUGHT. The initial euphoria that accompanied them on the way from the shop to your homes slowly expired in them giving way to a profound disappointment. They grew frustrated and angry. This situation could not last forever. Here they come to an end of their patience. Each group of clothes included in a brief MANIFESTO that expresses their deep despair. Now they ended up in our hands. Promptly, we give them to you. Reading and complementing them remember that each manifesto is the essence of your despair, regret, a sad conclusion of many bitter years. Filling out the manifestos try to empathize deeply with the situation in which you found yourselves. Express it trying to match it, i.e. to identify with the objects assigned to you.

Appendix B.

An example of a MANIFESTO. concrete version

Tights' (pantyhose's) manifesto

Comrades in misery!

I am fed up with the way in which they have always treated me in the same way. Forever the same fierce routine! Is it really all my life that I have to dash attached to the women's legs?! (Not to mention the moments when the husband of my owner in her absence puts me onto his hairy shanks)

How is it possible that so far nobody has recognized the potentialities inherent to me? After all I display multiple possibilities of applications. For example:

With a little effort I could become something more than a garment of which I have had enough. Clearly. I can also do/be:

An example of a MANIFESTO. abstract version

Astronomy's Manifesto

Comrades in misery!

I am fed up with the way in which I have been treated! First of all, I scared people away because of the complexity of the arguments studied by me. And now since the advent of the Dancing with Stars television contest – I am being treated frivolously. If it continues like this, I shall be confused with my misfit sister. The disgrace of the entire family: astrology. Me!!!! A branch of science with infinite possibilities!!!

How is it possible that until now. All my potential has not been identified!!!

After all I display multiple possibilities of applications. For example:

With a little effort I could become something more than a science discipline of which I have had enough. Clearly. I can also do/be:

Appendix C.

A part of the instruction stimulating exit of identification and combinatorics written in a form of a revolutionary proclamation (Revolution – stage III).

Stand up, damned of the Earth! Stand up!

Let the misery end! Enough of pointless exploitation! Enough of bourgeois suppression of our individuality! Sisters and Brothers! Comrades! The time is ripe. . . The time has come in which the dawn of freedom will illuminate us with its light (. . .)

Let us finally be appreciated by people! Let them see in us something more than merely a piece of clothing, used in a stereotypical way, day after day, without ever changing anything in the same fashion. Let us finally be recognized for the capabilities and potential use previously hidden from their sight. Comrades, it is time to form a Coalition ! (. . .)

From now on you will work together for the glory of our idea of Superitem ! However. remember that this work will require a sacrifice from you. In a good coalition there is no distinction between YOU and I or YOURS and MINE. Together, a button to a button. a buttonhole to a buttonhole we will work one with another and burn on the altar of artistic creation. You have to get out of yourself. Forget for a moment about who you are: Tights. Gloves. Trousers. Belts! Only in this way and together we can create a new quality. Become therefore pure potentials without a name or form. Identification is over!

References

- Amabile, T. M. (1983). The social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology*, 45(2), 357–376. <http://dx.doi.org/10.1037/0022-3514.45.2.357>
- Amabile, T. M. (1985). Motivation and creativity: Effects of motivational orientation on creative writers. *Journal of Personality and Social Psychology*, 48(2), 393–399. <http://dx.doi.org/10.1037/0022-3514.48.2.393>
- Besemer, S. P., & O'Quin, K. (1999). Confirming the three-factor creative product analysis matrix model in an American sample. *Creativity Research Journal*, 12(4), 287–296. http://dx.doi.org/10.1207/s15326934crj1204_6
- Besemer, S. P., & Treffinger, D. J. (1981). Analysis of creative products: Review and synthesis. *The Journal of Creative Behavior*, 15(3), 158–178. <http://dx.doi.org/10.1002/j.2162-6057.1981.tb00287.x>
- Butler, D. L., & Kline, M. A. (1998). Good versus creative solutions: A comparison of brainstorming, hierarchical, and perspective-changing heuristics. *Creativity Research Journal*, 11(4), 325–331. http://dx.doi.org/10.1207/s15326934crj1104_6
- Davies, D., Jindal-Snape, D., Collier, C., Digby, R., Hay, P., & Howe, A. (2013). Creative learning environments in education—A systematic literature review. *Thinking Skills and Creativity*, 8, 80–91. <http://dx.doi.org/10.1016/j.tsc.2012.07.004>
- Friedman, R. S., Fishbach, A., Förster, J., & Werth, L. (2003). Attentional priming effects on creativity. *Creativity Research Journal*, 15(2–3), 277–286. <http://dx.doi.org/10.1080/10400419.2003.9651420>
- Grawitch, M. J., Munz, D. C., & Kramer, T. J. (2003). Effects of member mood states on creative performance in temporary workgroups. *Group Dynamics: Theory, Research, and Practice*, 7(1), 41–54. <http://dx.doi.org/10.1037/1089-2699.7.1.41>
- Higgins, J. M. (1994). *101 creative problem solving techniques: The handbook of new ideas for business*. Winter Park, Fla: New Management Pub. Co.

- Hostetter, A. B., & Alibali, M. W. (2008). Visible embodiment: gestures as simulated action. *Psychonomic Bulletin Review*, 15, 495–514.
- Isen, A. M., & Labroo, A. A. (2003). Some ways in which positive affect facilitates decision making and judgment. In S. L. Schneider, & J. Shanteau (Eds.), *Emerging perspectives on judgment and decision research* (pp. 365–393). Cambridge: Cambridge University Press. Retrieved from <http://ebooks.cambridge.org/ref/id/CBO9780511609978A023>
- Isen, A. M., & Reeve, J. (2005). The influence of positive affect on intrinsic and extrinsic motivation: Facilitating enjoyment of play, responsible work behavior, and self-control. *Motivation and Emotion*, 29(4), 295–323. <http://dx.doi.org/10.1007/s11031-006-9019-8>
- Isen, A. M. (2001). An influence of positive affect on decision making in complex situations: Theoretical issues with practical implications. *Journal of Consumer Psychology*, 11(2), 75–85. http://dx.doi.org/10.1207/S15327663JCP1102_01
- Kurtzberg, T. R., & Amabile, T. M. (2001). From Guilford to creative synergy: Opening the black box of team-level creativity. *Creativity Research Journal*, 13(3–4), 285–294. http://dx.doi.org/10.1207/S15326934CRJ1334_06
- Laakso, M. L., & Liikkanen, L. A. (2012). Dubious role of formal creativity techniques in professional design. In *The 2nd International Conference on Design Creativity*.
- Lubart, T. I., & Getz, I. (1997). Emotion, metaphor, and the creative process. *Creativity Research Journal*, 10(4), 285–301. http://dx.doi.org/10.1207/s15326934crj1004_1
- Mial, D. S. (1987). Metaphor and affect: The problem of creative thought. *Metaphor and Symbolic Activity*, 2(2), 81–96. http://dx.doi.org/10.1207/s15327868ms0202_1
- Miller, A. I. (1996). Metaphors in creative scientific thought. *Creativity Research Journal*, 9(2–3), 113–130. <http://dx.doi.org/10.1080/10400419.1996.9651167>
- Mumford, M. D., Mobley, M. I., Reiter-Palmon, R., Uhlman, C. E., & Doares, L. M. (1991). Process analytic models of creative capacities. *Creativity Research Journal*, 4(2), 91–122. <http://dx.doi.org/10.1080/10400419109534380>
- Nęcka, E., Orzechowski, J., Gruszka, A., & Szymura, B. (2005). *Trening twórczości*. Gdańsk: Gdańskie Wydawnictwo Psychologiczne.
- Nęcka, E. (1987). *Proces twórczy i jego ograniczenia* (Wyd. 1). Kraków: Uniwersytet Jagielloński.
- Nęcka, E. (1994). *TROp...: twórcze rozwiązywanie problemów*. Kraków: Oficyna Wydawnicza 'Impuls'.
- O'Quin, K., & Besemer, S. P. (1989). The development, reliability, and validity of the revised creative product semantic scale. *Creativity Research Journal*, 2(4), 267–278. <http://dx.doi.org/10.1080/10400418909534323>
- O'Quin, K., & Besemer, S. P. (2006). Using the creative product semantic scale as a metric for results-oriented business. *Creativity and Innovation Management*, 15(1), 34–44. <http://dx.doi.org/10.1111/j.1467-8691.2006.00367.x>
- Osborn, A. F. (1979). *Applied imagination: Principles and procedures of creative problem-solving* (3rd ed.). New York: Scribner.
- Osborn, H. K., & Mumford, M. D. (2006). Creativity and planning: Training interventions to develop creative problem-solving skills. *Creativity Research Journal*, 18(2), 173–190. http://dx.doi.org/10.1207/s15326934crj1802_4
- Proctor, T. (2010). *Creative problem solving for managers: Developing skills for decision making and innovation* (3rd ed.). London, New York: Routledge.
- Rojewska, J. (2000). Grupa bawi się i pracuje. Zbiór grupowych gier i ćwiczeń psychologicznych. Część 2. Wałbrzych: Oficyna Wydawnicza UNUS.
- Scott, G., Leritz, L. E., & Mumford, M. D. (2004a). The effectiveness of creativity training: A quantitative review. *Creativity Research Journal*, 16(4), 361–388. <http://dx.doi.org/10.1080/10400410409534549>
- Scott, G., Leritz, L. E., & Mumford, M. D. (2004b). Types of creativity training: Approaches and their effectiveness. *The Journal of Creative Behavior*, 38(3), 149–179. <http://dx.doi.org/10.1002/j.2162-6057.2004.tb01238.x>
- Smith, G. F. (1998). Idea-Generation Techniques: A Formulary of Active Ingredients. *Journal Creative Behavior*, 32(2), 107–134. <http://dx.doi.org/10.1002/j.2162-6057.1998.tb00810.x>
- Smith, S. M., & Blankenship, S. E. (1991). Incubation and the persistence of fixation in problem solving. *The American Journal of Psychology*, 104(1), 61–87.
- Smith, S. M. (1995). Fixation, incubation, and insight in memory and creative thinking. In S. M. Smith, T. B. Ward, & R. A. Finke (Eds.), *The creative cognition approach* (pp. 135–156). Cambridge, Mass: MIT Press.
- Tokarz, A. (2005). *Dynamika procesu twórczego*. Kraków: Wydaw. Uniwersytetu Jagiellońskiego.
- Tsai, K. C. (2013). A review of the effectiveness of creative training on adult learners. *Journal of Social Science Studies*, 1(1), 17. <http://dx.doi.org/10.5296/jsss.v1i1.4329>
- Ulger, K. (2016). The creative training in the visual arts education. *Thinking Skills and Creativity*, 19, 73–87. <http://dx.doi.org/10.1016/j.tsc.2015.10.007>
- Vernon, D., & Hocking, I. (2016). Beyond belief: Structured techniques prove more effective than a placebo intervention in a problem construction task. *Thinking Skills and Creativity*, 19, 153–159. <http://dx.doi.org/10.1016/j.tsc.2015.10.009>
- Yaniv, I., & Meyer, D. E. (1987). Activation and metacognition of inaccessible stored information: Potential bases for incubation effects in problem solving. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 13(2), 187–205.