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THE CREATION OF A WORK OF ART AND THE METHOD OF SERIAL REPRODUCTION OF GEOMETRIC STIMULI

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Abstract. *Bartlett's serial reproduction experiments (Bartlett 1932), in addition to cognitive and social psychology, find their application in research into changes in culture and art. The application of similar techniques such as Cadavre exquis (Exquisite corpse) in modern art is discussed. Starting from Martindale's idea that serial reproduction experiments can be used to examine and simulate real stylistic changes, it was hypothesized that they could also be applied in examining the genesis of a work of art. Experimental research was conducted in two phases. In the first one, students of the Faculty of Arts (N=30) reproduced three geometric stimuli using the method of group serial reproduction with the instruction to increase originality in ten stages. Thus, 30 stimuli were obtained for further research. In the second part, psychology students (N=270) gave aesthetic evaluations of reproductions on the scales of semantic differential. The results of the liking (ND) and artistic evaluation (UV) scales were discussed in the paper. The qualitative and quantitative analysis of the results shows that the transformations went in the direction of rationalization and emphasis, but not in the work of simplification. The growth trend of ND and UV was recorded as a function of reproduction phases. Thus, the initial hypotheses of the research were confirmed. Later reproductions in the series scored higher on these scales. Psychology students show consistency in their judgments of liking and artistic value, which may indicate their appropriate aesthetic taste. In subsequent research, it should be checked whether aesthetic patterns and preferences differ between subjects with artistic education and those without such education. It is also necessary to include experiments of individual serial reproduction with the instruction of increasing originality in order to more faithfully simulate the process of creating a work of art.*

Key words: *method of serial reproduction, cadavre esquis, picture genesis, aesthetic evaluation*

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1. INTRODUCTION

The creation of a work of art is a complex and mysterious act. Although many philosophers, aestheticians, psychologists, as well as artists themselves, have written about the genesis of a work of art and creativity, little is still known about this process. The attitude of some scientists (especially in behaviorism) is often present that art and artistic creation cannot be the subject of science, and thus neither of psychology (cf. Ognjenović 1997, Milićević 2005, 2019). On the other hand, some genius artists, such as Pablo Picasso, believed in such a possibility of scientifically exploring the creative path:

"Paintings are but research and experiment. I never do a painting as a work of art. All of them are researches. I search constantly and there is a logical sequence in all this research. That's why I mark them with ordinal numbers. It is an experiment in time. I mark them in order and date them. Maybe one day someone will be grateful to me" (Picasso – Alexander Liberman; Picasso 1923, May).

The application of serial reproduction methods is associated with the legendary British psychologist and professor of psychology at the University of Cambridge, Sir Frederick Charles Bartlett (Bartlett 1932). It is a technique that Bartlett used to study memory in a social context. Serial reproduction involves not only memory, but also more complex factors such as, for example, social ones. It has also been shown that memory is not literally a replicating process, but that it is primarily a reconstructive process. The discovery of serial reproduction methods opened up new opportunities in psychology and initiated a series of new research in different areas of human behavior (Mesoudi 2004, 2005, 2007; Milićević 2011, 2024). Serial reproduction is increasingly applied in the field of culture and art, as well as in the study of its transmission.

The method is similar to the children's game Broken Telephone. The first participant in the chain watches or listens to certain material. After that, after some time, he has the task of recalling it and reproducing it. The respondent transmits the reproduced material to another participant in the chain by memory. This second participant receives the same task and so on until the end of the sequence. Transformations that occur in the material during reproduction can be studied (their number, intensity, speed of transformations, etc.). Bartlett initially used verbal material (short stories) and later visual material (various simple drawings).

Based on the analysis of reproduced materials, Bartlett comes to the conclusion that transformations take place in three main directions:

1. Simplification of content;
2. Rationalization: the unknown and foreign are replaced by the known and the content becomes acceptable, understandable and close to the respondent; and
3. Emphasis or dominance. Certain parts that were not highlighted in the original material become emphasized and dominant during reproduction.

Serial reproduction in art – Cadavre esquis (Exquisite corpse)

In addition to the games that preceded Bartlett's technique, a method very reminiscent of serial reproduction was applied in certain painting directions of modern painting.

So, for example, the Surrealists used the Cadavre exquis (or Exquisite corpse) technique. It is a technique derived from a kind of game (Kochhar-Lindgren, K., Schneiderman, D., & Denlinger, T. (Eds.) 2009).

According to Breton's memory (Breton 1948; William 1985), this game, i.e. the technique was created around 1925 during evening gatherings of a group of surrealists (among them: Marcel Duhamel, Jacques Prévert, Yves Tanguy, Benjamin Péret and Tristan Tzara). When they ran out of topics to talk about, in order not to get bored, they found inspiration in some old parlour games such as the game Consequences. The game initially consisted of collecting collections of words and collectively matching them. Players write in a circle on a sheet of paper, then fold it to hide part of the writing and pass it to the next participant to write his part. Later, surrealists extended this method to paintings and making collages. Each participant in the game adds his part to the composition in sequences, following certain rules, with permission or without seeing what previous person added.

This technique was also popularized later by many painters. We will mention Frida Kahlo (Frida Kahlo) and Lucienne Bloch (Lucienne Bloch), and our Serbian surrealist, Marko Ristić (1902 – 1984).

This technique has also been applied in other arts: in music (Virgil Thomson, John Cage and Lou Harrison), theater (a performance by the San Francisco Cacophony Society), cartoons (e.g. Marv Newland, Anijam 1984) and films (e.g. Apichatpong Weerasethakul, director, 2000, Mysterious Object at Noon).

Cadavre exquis, or Exquisite corpse, is very reminiscent of Bartlett's method of serial reproduction, because each new individual also adds his contributions to the final work, primarily by his transformations of the material of his predecessor. Cumulative changes in the sequence leading to qualitative changes in the initial stimulus are usually sudden, unexpected and original.

Serial reproduction as a simulation of stylistic changes

We will mention one interesting experiment whose results are significant for our research. It is about Ward's experiment (Ward 1949, according to Mesoudi 2005; Martindale 1990) in which the subjects had the task of reproducing a drawing of a coin from ancient Macedonia (around 350 BC) using the method of serial reproduction. After several reproductions, the design of the ancient original coin, resembled Gaelic and certain coins of later periods, eventually taking the form of early British coins. During the serial reproduction experiment, something very similar to the changes in history that actually happened. Cumulative copying errors corresponded to actual historical changes!

Colin Martindale (1990), based on Ward's findings, as well as on the basis of his own research, finds confirmation of his theory of aesthetic evolution in serial reproduction experiments. The changes that occur in serial reproduction experiments correspond to actual stylistic changes throughout the history of art. He concludes that serial reproduction experiments provide us with "a direct method for placing the history of art on an experimental basis" (Martindale 1990, p. 342). Through serial reproduction experiments, stylistic changes that have already taken place can be simulated to some extent.

Serial reproduction in creative process research

Based on Ward's (1949) and Martindale's (1990) findings, the question arises whether serial reproduction experiments can also simulate changes that occur in the process of creating a work of art.

We can assume that a similar process exists in the creation of an individual work of art. During the creation of and work on a certain piece, the artist tries to discover a more original

and adequate solution than the previous one. In this search, visual artists often make numerous preparatory sketches. These sketches can serve as material for examining the course of their creative process (Arnheim 1962; Weisberg 2004; Kozbelt 2006; Milićević 2001, 2005). In search for a new solution, the artist uses elements of his previous solutions which he refines, enriches or simplifies, trying to provide the best. This painstaking process never ends (Milićević 2011). This influence continues during the work on later new works of art, and is often transmitted to contemporaries or followers who maintain it in their creative career. Something similar is claimed by Weisberg (2004), who believes that the painter's creative process can be seen, foremost, as the elaboration of a "kernel idea".

However, the artist does not aim to faithfully copy the initial stimulus and his subsequent sketches, as is the case in classic serial reproduction experiments with the instruction to follow the original. On the contrary, the artist tries to make his sketches more original at every attempt. For this reason, a modified instruction (also used by Martindale, 1990) was used, in which the draftsman was asked to increase the originality of the reproduced drawing at each new attempt for a shade.

During the history of art, artists themselves had different attitudes towards imitation, i.e. reproduction. The entire history of art has ranged from extreme realistic representation of the world to complete abstraction and vice versa. Modern art especially, from Impressionism to today, had different approaches to painting reality (cf. Trifunović 1994; Arnason 1975).

Starting from Ward's results (1949) as well as Martindale's (1990) idea that the method of serial reproduction can represent a direct path to the experimental simulation of changes during the history of art, we came to the hypothesis that serial reproduction experiments could partially simulate what happened during the creation of an individual work of art. With that idea in mind, we organized several variations of serial reproduction experiments with students of the Faculty of Arts in Niš. Below, we will present only one part of those researches.

2. METHOD

The research was carried out in two phases. In the first part, three groups of ten students (30 in total) from the Department of Painting reproduced one of the initial geometric drawings using the method of group serial reproduction. In doing so, they were told to try to make each subsequent reproduction "a shade more original."

The initial stimuli were three simple geometric figures (Fig. 1Fig. 1):

Fig. 1 Three types of initial geometric stimuli in group serial reproduction

In the second phase, psychology students evaluated 30 stimuli obtained in this way on semantic differential scales. In this paper, we will deal only with aesthetic evaluations concerning their preferences, i.e. assessment of liking and assessment of artistic value.

A. Creation of stimuli

Method

Subjects:

In this part of the research, three groups of 10 final-year students of the Faculty of Arts in Niš from the Department of Painting (30 in total) of both sexes participated (18, i.e. 60% female and 12, i.e. 40% male).

Procedure:

The classic single chain of group serial reproduction was used in the research. In doing so, a certain content is reproduced (one of each of the three geometric drawings), so that the first subject copies the original content, the second makes a copy based on the copy of the first, the third copies based on the copy of the previous one, and so on until the last one, the tenth in the sequence. Each subject was orally instructed to "make his drawing a shade more original" without drastically changing the previous drawing. Each participant individually looked at a drawing from one series. The drawing was removed after one minute, and we placed on the classroom desk, in front of the examinee, a sheet of white paper of A4 format, vertically oriented (portrait), a graphite pencil and an eraser . Reaction time was not limited. Each subject reproduced one drawing from each series separately (three in total). When reproducing a new drawing, the order of subjects was changed to eliminate the influence of drawing skills, precision in reproduction, as well as the influence of individual styles and ideas on the future course of reproduction (Milićević 2011; 2019).

Stimuli

Three simple geometrical drawings were used: a) triangle with a circle in the middle, b) a circle with an inscribed triangle, and c) a square with an inscribed square (Fig. 1). The initial stimuli were presented on a sheet of white paper of A4 format, vertical orientation (portrait).

When it comes to geometric stimuli, earlier findings on a non-artistic population (Martindale, 1990; Milićević and Pejić, 2006) that transformations of geometric shapes take place the most slowly have not been confirmed. It should be remembered that the instruction was specific: to increase the originality of previous reproduction so that it was no longer about classical copying and adherence to the original, but about a creative creation of a new type of drawing. Another reason is that the subjects had artistic education, developed drawing abilities, certain talent and a creative potential. It was obvious that their associations with even the simplest stimuli, such as geometric ones, were more lively, unexpected and creative, and therefore further away from the basic initial model (Milićević 2011).

The great painter Paul Cézanne also said:

"Everything in nature is modeled as a ball, cup or roller. Painting must be learned on the basis of these simple forms" (Cézanne 1894, as cited in Trifunović 1994, p. 28)

3. Results and Discussion

The first geometric initial stimulus, a drawing of an equilateral triangle with a base of 7 cm and a circle in the center with a diameter of 3 cm, mostly retained all elements during the first five reproductions (Fig. 2). The circular shapes from the triangle in the third drawing move to the top, and the triangle slowly takes the shape of a pyramid by the fifth drawing. The sixth examinee draws two triangles joined at the tip, resembling an hourglass with an accentuated black dot in the middle. That was enough for the next subject in the series to associate this detail with a female body, and from that moment on, that idea

remains present until the last, tenth reproduction in the sequence. The geometric form is maintained until the sixth reproduction, and from the seventh to the tenth, the realistic female body remains dominant.

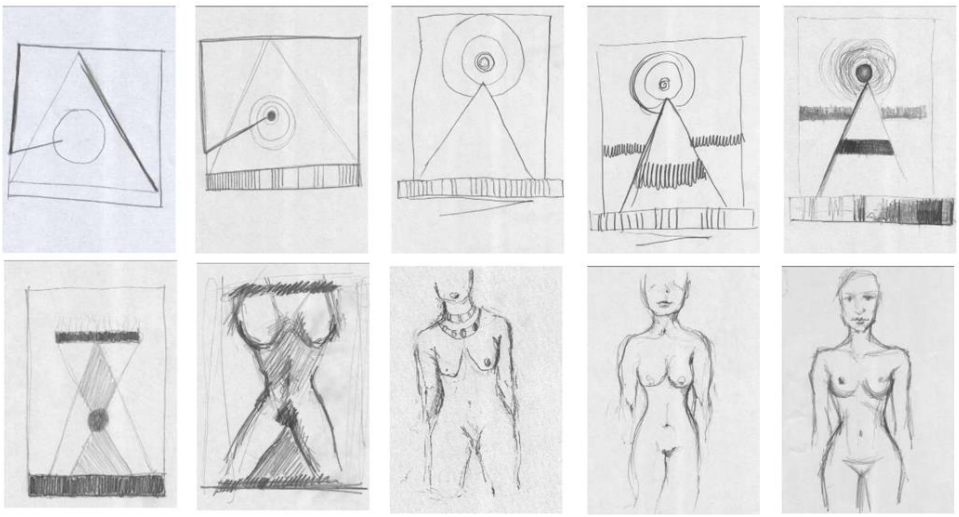

Fig. 2 Ten reproductions of the geometric stimulus – (triangle with a circle) in the "group" serial reproduction experiment with the instruction "increasing originality"

With the second geometric stimulus, a drawing of a circle with a diameter of 7 cm with an inscribed equilateral triangle with a base of 5 cm, changes occurred with similar dynamics as with previous one. Reproductions retain the geometric form up to the sixth in a row. The first two show a great similarity to the original, but a certain amount of decoration is present. In the third drawing, the elements are inverted, so the circle occupies the place in the center of an isosceles triangle placed on a rectangular base. The geometric image here already resembles a tree or a traffic sign. The fifth reproduction gains depth, i.e. the third dimension. A regular conical shape with a perspective background hints at the idea of a tree. From the sixth to the eighth reproduction, the trunk of the tree is still recognizable, i.e. a plant with roots. The background takes the form of a cube, i.e. boxes. In the ninth and tenth reproductions, the plant transforms into a human head, but retains the roots at the base (Fig. 3).

The third geometric drawing, a square page of 7 cm with an inscribed square, during all ten reproductions retains all the elements and geometric form, but with the addition of new smaller geometric details (Fig. 4). The reproductions have an abstract character, that is, they do not have a recognizable realistic meaning until the last drawing in the sequence.

With all geometric stimuli during reproductions, an increase in the number of elements and decoration, as well as the appearance of completely new ideas, is observable. These new ideas, although they seem like sudden changes, arose spontaneously in continuity as associations to previous stimuli that already suggested such an idea. For example, the transition of triangular forms to the female torso, although it represents a qualitative change, is already suggested in a way by the connected triangles and the black dot in the middle, which becomes the female genital organ. Decoration proved to be a dominant

method of increasing originality here, and of the three geometric stimuli, only the square within the square retained its geometric form and elements from the first to the last reproduction.

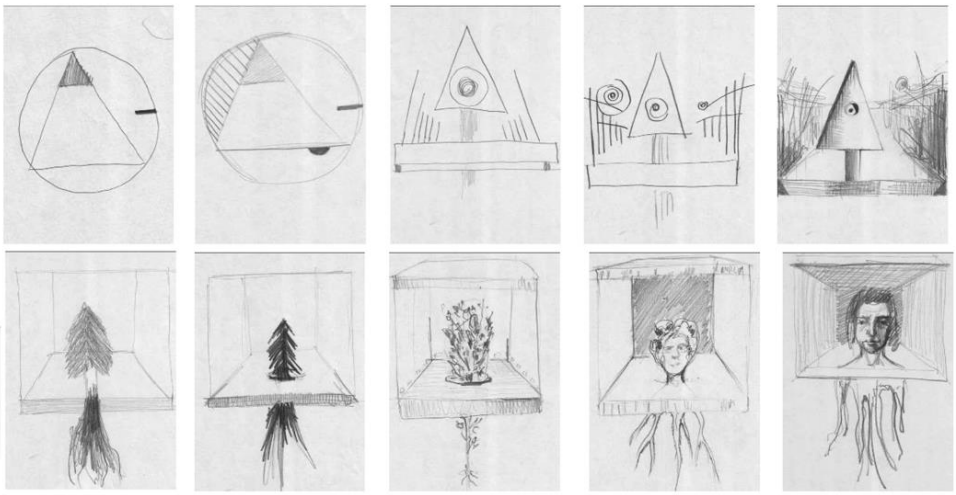

Fig. 3 Ten reproductions of the geometric stimulus (circle inscribed in a triangle) in the "group" serial reproduction experiment with the instruction "increasing originality"

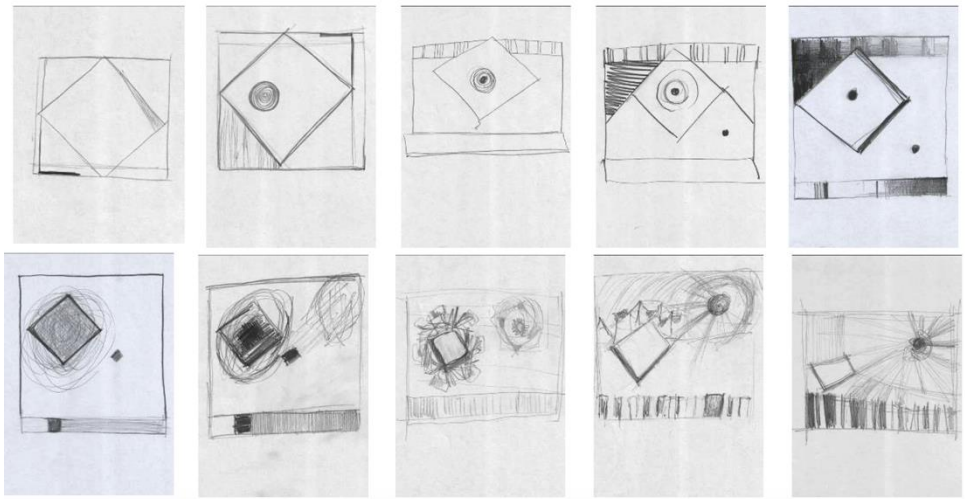

Fig. 4 Ten reproductions of the geometric stimulus – (square-inscribed in a square) in the group serial reproduction experiment with the instruction "increase originality"

Referring to previously mentioned Bartlett's conclusions about the direction of transformations (Bartlett 1932), it can be said here that the changes of the initial geometric drawings during group serial reproductions with the instruction to increase originality went

in the direction of a) rationalization and b) emphasis and dominance, but not in the direction of c) simplifications. Racialization is visible in that unfamiliar content is replaced by close and realistic content that is more acceptable to the examinee. Emphasis is present in some stages of reproduction, when individual secondary details gain importance and become prominent and dominant.

Simplification during reproduction did not occur, we assume, for the following three reasons. The first is in the characteristics of the initial stimuli. These were very simple geometric shapes so there wasn't much room for further simplification. Another reason lies in the type of instruction given. In contrast to classic experiments of serial reproduction, here the participants were asked to be a little more original in every presentation. And finally, the third reason is the characteristics of the respondents themselves. These are art students who already possess certain drawing skills and talent, which gives them the ability to make the reproductions truly more original than the previous ones.

B. Aesthetic evaluations of reproductions

In the second part of this research, psychology students evaluated all received stimuli using the method of group serial reproduction (30 in total) on semantic differential scales.

The main objectives of this part of the research were the following:

1. on a sample of respondents from the non-artistic population (psychology students), determine the aesthetic evaluations of reproduced geometric drawings-stimuli obtained by "group" serial reproduction on the aesthetic dimensions of liking (ND) and artistic value (UV);
2. determine the trend of these aesthetic evaluations, i.e. the way they changed during the stages of "group" serial reproduction of geometric stimuli with the instruction to increase originality.

Method

A sample

A total of 270 psychology students of the Faculty of Philosophy in Nis participated in this part of the research, of which 37 (13.7%) were male and 233 (86.3%) were female. The respondents were from all years and study levels.

Instruments

A set of 30 seven-point scales of the semantic differential type was used to measure aesthetic evaluations. In this paper, we will only present the results on the scales of liking (ND) /he doesn't like it, I like it/ and the scales of subjective assessments of artistic value (UV) /artistically worthless-artistically valuable/

Procedure

Subjects had the task to evaluate the stimuli displayed (on the LCD projector) on each of the scales from -1 to +3 without time limit. Subjects in groups (from 15 to 30) evaluated only one series of "group" drawings-reproductions, as well as the initial stimulus (11 in total). The stimuli were presented in chronological order, i.e. in the same order in which the serial reproductions were created.

Results

Regression analysis on a sample of psychology students shows that reproduction stages are a good predictor of liking ratings (ND) in reproduction of geometric stimuli. The appropriate linear regression equation () for geometric stimuli can explain 65% of the variance in liking ratings.

Estimates of the liking of geometric stimuli increase linearly as a function of the sequence (phase) of the stimuli reproduced (graph 1).

Table 1 Linear regression results for aesthetic evaluations of liking (ND) and artistic value (UV) of ten reproductions of geometric stimuli in psychology students

Estetic estimate	r^2 lin.	*Df*	*F*	*p*	regression equation
ND	.65	(1, 9)	16.67	.003**	ND = 0.148 faza-0.90
UV	.85	(1, 9)	58.80	.000***	UV = 0.179 faza-1.17

Note: ns-not statistically significant; * $p < .05$; ** $p < .01$; *** $p < .001$

The results of the aesthetic evaluations of the artistic value of the reproductions obtained of the geometric stimuli are similar to the previous ones.

The influence of the stages of reproduction and the type of reproduced material (geometrical) on the evaluation of the artistic value (UV) of serial reproductions was investigated by analysis of variance. A statistically significant separate influence of reproduction stages was determined, $F(10, 2937) = 21.91$, $p < .001$.

Regression analysis on a sample of psychology students showed that stages of reproduction are a good predictor of artistic value (UV) in reproduction of geometric stimuli. The corresponding linear regression equation (Table 1) in the case of reproductions of geometric stimuli can explain 85% of the variance of artistic value assessments. Estimates of artistic value of reproductions of geometric stimuli grow linearly as a function of order, i.e. phase (chart 1). This is in accordance with the hypotheses that have been confirmed here, as well as in accordance with aesthetic decision-making at three levels (Ognjenović 1980, 1991, 1994).

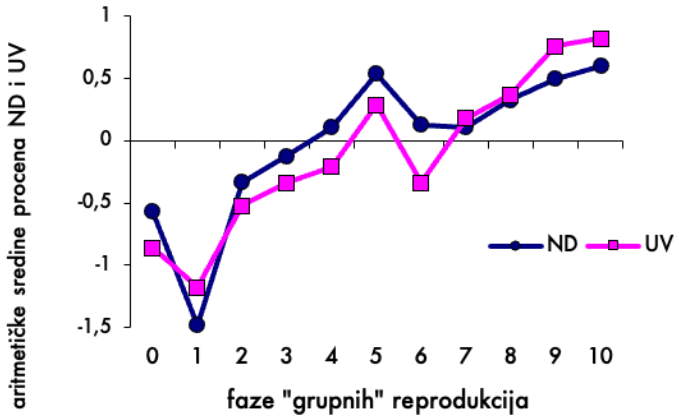

Fig. 5 Aesthetic assessments of liking (ND) and artistic value (UV) of ten stages of "group" serial reproductions of geometric, realistic and abstract stimuli by psychology students

4. CONCLUSIONS

Psychology students prefer stimuli that are from the later stages of reproduction. Liking shows a slight increase and statistical significance as a function of reproductive stages. If it is taken into account that the art students who made these reproductions were instructed to be "a shade more original" every time, then it can be concluded that psychology students without an art education show a greater preference for more original drawings. This seems encouraging in relation to some earlier findings that students prefer redundant, ornate stimuli that often have kitsch characteristics (Ognjenović and Morača 1994). It can be said that psychology students have appropriate aesthetic criteria, and accordingly the appropriate aesthetic taste.

Moreover, if it is taken into account that psychology students' evaluations of the artistic value of the displayed stimuli are similar to liking evaluations, this could mean that their criteria of "beautiful for me" and "artistically valuable" do not differ much. The trend for both shows positive growth. Later reproductions in the sequence were evaluated as more pleasing and artistically valuable.

However, the question remains whether art students have a more refined aesthetic taste and whether their assessments differ from those of non-artistic population. That is why these trends in terms of aesthetic evaluations should also be checked on a sample of art students.

Despite the significant information that the obtained results provide, there are still difficulties in this and similar research that should be overcome or at least reduced.

In order to obtain more reliable findings regarding the flow of transformations during serial reproductions, it is necessary to increase the number of reproduced stimuli. That is, it would be useful to apply multiple chains of reproduction, which would necessarily increase the sample size of the estimators.

Finally, it is necessary to examine transformations in "individual" serial reproduction experiments that would be closer to the real creative process. Namely, the artist tries to be more original in finding creative solutions during artistic creation in relation to his own previous solutions and not someone else's. That is why experiments with "individual" serial reproduction with the instruction of increasing originality were realized, where one person reproduces his previous reproductions. It would be useful to compare the results of both types of reproductions and to analyze the differences in the aesthetic evaluations of a sample of artists and non-artists.

Differences in the application of different forms of aesthetic assessments and preferences of "artists" and "non-artists" were obtained in some earlier research (Ognjenović and Morača 1994; Pejić 2003). Art students are better able to perceive fluctuations in quality during the development of a painting (Kozbelt 2006). It can be assumed that this could be the case here as well, so such verification remains to be done in further research.

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NASTAJANJE UMETNIČKOG DELA I METOD SERIJSKE REPRODUKCIJE

Bartletovi eksperimenti serijske reprodukcije (Bartlett 1932) pored kognitivne i socijalne psihologije svoju primenu nalaze u istraživanju promena u kulturi i umetnosti. Razmatrana je primena sličnih tehnika kao što je Cadavre exquis (Exquisite corpse) u modernoj umetnosti. Polazeći od Martindejlove ideje da se eksperimentima serijske reprodukcije mogu ispitivati i simulirati stvarne stilske promene došlo se do hipoteze da bi se mogli primeniti i u ispitivanju geneze umetničkog dela. Sprovedeno je eksperimentalno istraživanje u dve faze. U prvoj su studenti Fakulteta umetnosti (N=30) reprodukovali tri geometrijska stimulusa metodom grupne serijske reprodukcije sa instrukcijom povećanja originalnosti u deset faza. Tako je dobijeno 30 stimulusa za dalji tok istraživanja. U drugom delu su studenti psihologije (N=270) davali estetske procene reprodukcija na skalama semantičkog diferencijala. U radu su razmatran rezultati na skalama dopadanja (ND) i umetničkog vrednovanja (UV). Kvalitativna i kvantitativna analiza rezultata pokazuje da su transformacije išle u pravcu racionalizovanja i naglašavanja, ali ne i u pravcu simplifikacije. Evidentiran je trend rasta ND i UV u funkciji faza reprodukcije. Time su početne hipoteze istraživanja potvrđene. Kasnije reprodukcije u nizu dobijale su više procene na ovim skalama. Studenti psihologije pokazuju doslednost u procenama dopadanja i umetničke vrednosti, što može da govori o njihovom adekvatnom estetskom ukusu. U narednim istraživanjima treba proveriti da li se estetski obrasci i preferencije razlikuju kod ispitanika sa umetničkim obrazovanjem od onih koji takvo obrazovanje nemaju. Takođe potrebno je uključiti i eksperimente individualne serijske reprodukcije sa instrukcijom povećanja originalnosti kako bi se još vernije simulirao proces nastajanja umetničkog dela.

Ključne reči*: metod serijske reprodukcije, cadavre esquis, geneza slike, estetske procene*