STUDIES IN CREATIVITY

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Preface

Creativity research in Hungary started relatively late, in the second half of the sixties. The Psychology Department of the Eötvös Loránd University had played a decisive role in this process. At first, practical considerations determined the choice of research topics, and therefore we had deemed the Hungarian adaptation of creativity tests the most important. But in a short while there followed investigations of different relationships, in which the individual interests of the researchers themselves were decisive.

The variety of topics in this volume gives an accurate picture of this state of affairs. The studies investigate creativity from the point of view of basic perceptual characteristics through motivational and attitudinal factors to personality variables, as well as the cognitive component of creativity, as measured by tests. Although fundamental data are identical, some of the results differ from those of well-known experiments, while others modify or complement them with new aspects, thus enriching our knowledge in this area.

Most of these studies are based on research conducted in the past fifteen years and have been published only in Hungary. Although some of them had been written in the early seventies, and creativity research is continued at our department now as well, we have decided to go on with the publication of this selection made in 1980 in the hope that the works presented here are still of interest.

Creativity research is conducted at our department with a more intensively experimental orientation in order to define basic phenomena and with the aim to develop creativity. In addition, in a number of other institutions researchers are doing multifaceted and noteworthy work in this area.

The Editors

Annamária Komlósi

Creativity and perception

Recent studies of creative persons, which is one of the rapidly developing major research areas, suggest that the characteristics of creative persons cannot be indentified with some isolated mental or motivational trait, but only with the whole personality.

Regarding the dynamic interaction of psychological functions, we believe it is right to assume that differences between creative and non-creative persons are reflected even on the level of certain elementary processes.

Martindale and Hines (1973) reported two sets of data which corroborate the above assumption: on the one hand, they were able to demonstrate that during the solution of creativity tests more alpha activity was recorded in the EEG of highly creative persons compared with that of less creative subjects. And, on the other hand, according to their study, in a relaxed state highly creative persons displayed more theta rhythm and less alpha activity with closed eyes, while with their eyes open they produced more theta and more alpha activity as compared with the poorly creative group.

In our study we expected to find differences in the *elementary perceptual processes* of creative and non-creative persons.

In forming our hypothesis two points were taken into consideration. The first was that inasmuch as creativity is regarded as a highly organized form of active adaptation, perception (primarily visual perception) should play a salient part in this adaptation, since the active adaptational characteristics of visual perception have been described by many authors (see Zinchenko, 1969; Vári-Szilágyi, 1969). The other was provided by the results of experimental research of perception within the framework of the so-called cognitive regulative principles indicating possible individual differences and typological characteristics in perception. (For a classical review see Gardner, 1959.)

On the basis of the motivational characteristics of creative persons, a specific relationship was assumed between the "repression-sensitization" dimension (Gordon, 1957) and creativity, suggesting that extreme repression – which practically stands for ego defense and prompts the repression of negative stimuli and drives – is not likely to be found in creative persons. Namely, the tolerance of tension of creative persons (Drevdahl and Cattell, 1958; MacKinnon, 1970), their medium strength anxiety – that is, not extreme, but optimal (Wallach and Kogan, 1965) – furthermore, their capacity to regrediate to primary processes without danger of mental impairment (Pine and Holt, 1960; Roe, 1961; MacKinnon, 1970; Dellas and Gaier, 1970) are known from numerous studies. All these characteristics, related to the outstanding ego strength of creatives, suggest their ability to utilize their motivational energy extensively and also to face unpleasant, negative information. Consequently, they are more open to stimuli from both the outer and the inner world, as compared to non-creative persons.

From among the cognitive regulative principles, field dependence and field independence, originally described by Witkin, were indirectly related to creativity by some authors (Witkin, 1962), and directly by others (Bloomberg, 1967), assuming a positive relationship between *field independence* and creativity.

On the basis of these results, our hypothesis was the following: assuming that specific differences should be manifest in the elementary visual processes of creative and non-creative persons, our purpose was to demonstrate in a specific experimental situation that neutral visual stimuli exposed under suboptimal conditions would be recognized faster and more precisely by creative than by non-creative persons.

Methods

Subjects

As a first step, two groups of subjects were formed by a twofold selection, consisting of creative and non-creative persons respectively. First, high school graduating students, first-year university under-

graduates and students from the College of Design (aged 17–23) ranked the members of their smaller training groups on the basis of a list of traits characteristic of creative individuals. (See the text of the list in the *Appendix*.) Subsequently, those persons who were ranked the highest and the lowest, performed the following five creativity tests adapted to the Hungarian population by Barkóczi: "Sentence Completion", "Unusual Uses", "Consequences", "Remote Association", "Mathematical Task". In the five tests, fluency, flexibility and originality values were calculated by Barkóczi and Klein's (1968) evaluation method. The individuals were re-ranked according to their respective scores, and those occupying the highest and lowest positions in the list were selected for further examination. The Mann–Whitney *U*-test indicated a significant difference ($p < 0.05$) between the two groups formed by the above procedure.

In the actual experiment only the 45 subjects (27 highly creative and 18 poorly creative), selected from approximately 300 persons, participated.

Procedure

Simple geometric patterns or schematic line drawings (see Figure 1) were exposed by a projection tachistoscope (with an exposition time of 10 ms) upon a screen on which colourful, well discernible and neutral pictures (flowers, landscapes, buildings) were constantly projected in a darkened room. (The size of the picture on the screen was 1×1 m. The subject was sitting 3 m away from the screen.) The background and the experimental stimuli were presented in pairs, that is, each tachistoscopic figure was projected on a different background picture. Ten stimuli and ten background pictures were used. First the colourful, well discernible background picture appeared on the screen (for a detailed description of the backgrounds see the *Appendix*) followed by the stimulus figure projected rhythmically with the same exposition time (with 15 ms breaks).

The following instruction was given: "Slides will be projected and after a time something else will be projected on them with a very short exposition time. Your task will be to recognize this briefly projected figure. Each figure will be exposed several times succes-

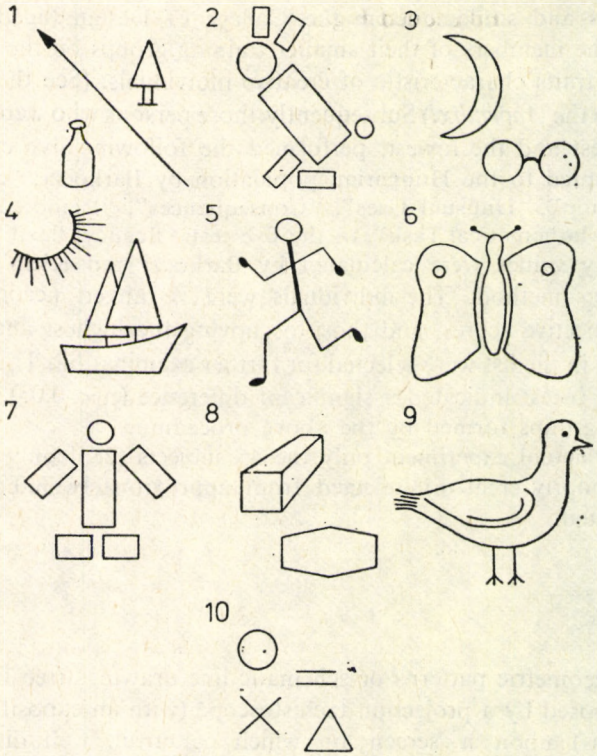

Figure 1

sively. If you think you have recognized it or have seen it, indicate it at once, and tell us or make a drawing of what you have seen."

Thus, it was actually possible to follow closely the process and stages of recognition, since the subjects immediately indicated if their perception was enriched by some new element.

In designing the above procedure, the method applied by Witkin *et al.* (1962) for the measurement of field independence and field dependence in the "Embedded Figures Test" was partly adopted. That is, one of the perceptual tasks of our subjects was to identify a pattern in a complex whole: they had to overcome the confusing effect of the background. However, our method deviated on two points

from that of the Embedded Figures. One of the differences was that in our experiment the "background" was not geometrical, but figural, although – as far as it was possible – it was neutral. The other difference was that in this experiment the subjects were not told what they should see or seek. This latter point is particularly important since it was assumed that the process of recognition during the successive expositions may also be characteristically different in the creative and the non-creative groups.

Recognition was characterized by the number of expositions needed, and by the comments of the subjects after each exposition on what they had seen.

From these data the following indices were calculated:

1. Group mean of the number of expositions needed for the recognition of each picture for both groups.
2. Overall mean of the number of expositions needed for the recognition of all pictures in both groups. The two groups were compared for each picture and according to the overall mean of expositions on the basis of χ^2 values computed from 2×2 contingency tables (median test).
3. Content comparison of data given by the two groups. It ought to be mentioned that the neutrality of the "base pictures" was not tested. The only criterion considered was that the pictures possess no incentive value in the conventional sense of the word, that is, that they have no sexual, agressive, etc. meaning.

Results

Our hypothesis, according to which the recognition time of stimuli displayed under the condition of short exposition time and confusing background was assumed to be shorter in the creative group compared to the non-creative group, was supported by the indices described above.

Highly creative persons needed less expositions for the recognition of each picture, consequently their total number of expositions was also lower (see Figure 2).

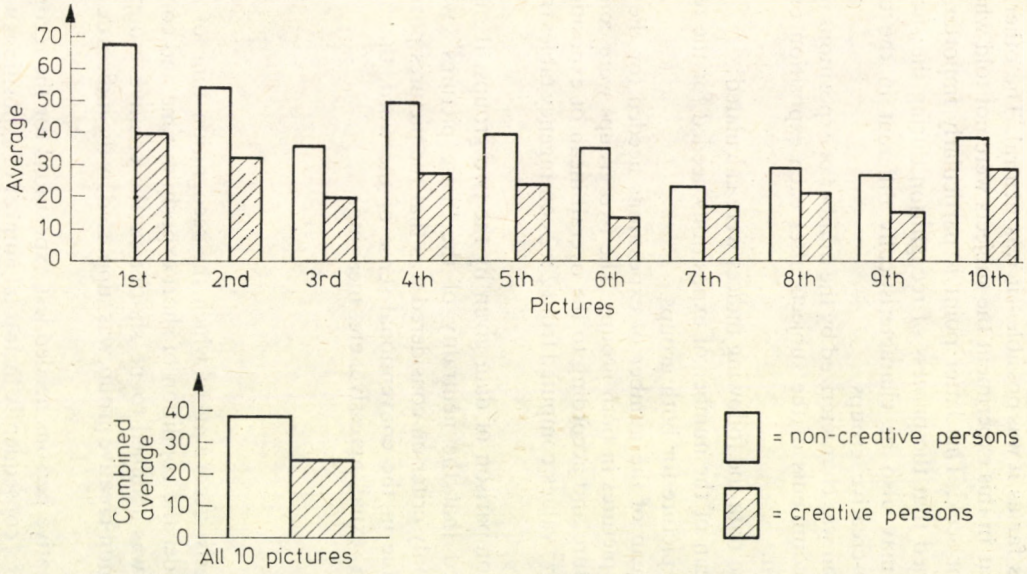

Figure 2. Average number of expositions necessary for the recognition of the 10 stimulus pictures

As it is seen in Figure 2, in the case of three pictures the differences between the two groups in the speed of recognition of stimulus figures were not significant. The reason for this obviously lies in the formal and content characteristics of the pictures.

In the case of the second and eighth pictures the choice of background was evidently not adequate, namely, in these cases the background was not in colour but black and white. As a result, the stimulus figure almost totally blended into the black and white patterned background, that is, the conditions for the perception of form were not sufficient. The fact that creative persons tended to perform better even here is due to their accurate recognition of certain parts or of the majority of parts, although they, too, were unable to discern the whole figure. The lack of significance in the case of the seventh picture might have resulted from the fact that the average recognition time was the lowest, that is, the figure was soon indentified by almost everybody.

The background figure as a confounding factor hindered the process of recognition in everybody, but presumably more in the case of non-creatives. This might be inferred from their more prolonged process of recognition and from their difficulties in ignoring the background – as it was indeed verbalized by some of them.

It would be overambitious to draw far-reaching conclusions about the differences in the process of recognition in creative and non-creative persons on the basis of our experiment. However, some of the results are worth mentioning. Some subjects tended to list geometric components in the case of figural pictures (like the sail boat [No. 4] or the butterfly [No. 6]), too, while others immediately organized the components into some kind of a pattern. In fact, these two ways of seeing emerged in both groups, but it seems that in creative persons, besides the global approach to stimuli, the analytic way of seeing is more frequent, compared to non-creative persons. Creative persons indicated a pattern mainly in those cases where it nearly fitted the real pattern; e.g., to the third picture responses like glasses, barbell, etc. were given. Non-creative persons, however, tended to apply the same pattern to everything. For example, in the case of the fourth picture, there was a subject who called the schema-

tic sun a tap, a running rider, outstretched fingers, etc. That is to say, they immediately attributed the characteristics of some global pattern to the unknown item. It occurred in their group that, unlike the previous example where a remote image was applied to the pattern, a very closely related, almost identical pattern was applied, and their perception was so persevering that they did not modify it even after a number of expositions. For example, three subjects said that the arrow in the middle of the first picture was the numeral 1, and they did not change their opinion throughout the test.

On the basis of these data we may assume that in creative persons the analytic processes are more readily mobilized to organize information into patterns. (This corresponds to Bloomberg's finding (1967), according to which field independence is a necessary but not sufficient condition of creativity.) That is, they can handle the components of a pattern more easily than non-creatives who tend to globalize.

Creative persons perform better and with greater ease in divergent tasks simply because the information is at their disposal in "distinct units", while non-creatives tend to mobilize closed, global patterns more readily.

These facts can be related to those findings, according to which, highly anxious persons tend to retain responses of great habit strength and conventionality, that is, they form more rigid patterns as a defence, which they can mobilize in cases of high activation. (This explains the impaired performance of anxious persons in divergent tasks; see Kovács and Pléh, this volume.) The tolerance of tension in creatives enables them to avoid the fixation of such rigid patterns. (Sz. Deák's [1973] finding that there is a dynamic-plastic set in creatives can be connected to the above results.) We cannot as yet pinpoint the mechanism responsible for this phenomenon, but it is reasonable to make a distinction in the effect of the motivational system on perception in respect of creative and non-creative persons. This difference may be manifested in the fact that these structures do not have an inhibiting or distorting effect in the case of creative persons as opposed to non-creative ones.

Summary

The primary goal of our study was to prove that creativity as a special active adaptational process, by way of which outer and inner impulses can be utilized in a wide range, may be found not only on the level of highly organized functions but also on the level of elementary perceptual processes. Our hypothesis stated that under suboptimal conditions in perceptual tasks creative persons are more open to stimuli. Our experiment seems to support this assumption: creative persons outperformed their non-creative mates: under difficult conditions they were able to recognize neutral stimuli with greater accuracy and speed. An additional interest of the results is that although the selection of subjects participating in the experiment was performed by verbal creativity tests, the difference between these two groups was also present on the level of perception.

Appendix

The trait list used in the first phase of the selection of creative persons:
They have independent, original ideas upon which they insist despite the adverse opinion of others.
They are able to ignore established procedures and conventions when necessary.
They are characterized by keen interest, inventiveness and intellectual problem solving.
They do not aspire to personal success but to the progress of a project and to the joy of thinking.
They are not frightened by unsolved problems, by complexity or ambiguity.

We do not mean those persons who are characterized by the accumulation of facts, by the aspiration for good marks and by good memory, who learn easily and are successful, but those who are original, non-conformist and gifted.

The background pictures of the experiment:

1. Yellow-brown rocky mountain. At the bottom of the mountain there are two people in sports-clothing, a man and a woman, who seem tiny in comparison to the mountain.

2. Waterworn, stony, gravelled landscape in black and white.

3. Blue, empty tram. The car in the middle is well discernible, but only small parts of the first and last cars can be seen. Above, in the background, the façades of a few houses and the branches of a few trees are seen: these are a brownish shade.

4. A bird's-eye view of a small provincial settlement beset by cultivated lands. Green and brown colours dominate the picture.

5. Tomato cut in half, the seeds and veins are apparent. Its colour is natural red.

6. Four armchairs of modern design: two of them are red, the other two are white, partly covering one another.

7. In front of a sand coloured background the head of a flower can be seen with orange stamen and transparent petals with drops of water on it.

8. One piece of tomato under a glass bell, in black and white.

9. Southern scene: green lawn, a cactus and a palmtree in the front, and a few two-storied white houses and blue sky in the background.

10. High, greenish-brown sandhills under the blue sky.

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Ilona Barkóczi, Katalin Büchler and János László

The effect of creativity and preference for complexity on solving maze tasks*

Interrelations between creativity and preference for complexity have been demonstrated by Barron (1953, 1963). Creative persons have been shown to favour complex situations and to tolerate well the conflicts they involve (Taylor, 1964). However, differentiation between the levels of difficulty and complexity of a task is a generally unresolved problem, because difficulty increases together with complexity.

Both creativity and preference for complexity have been hypothesized to secure a good start in the solution of the more complex tasks with the same degree of difficulty.

Methods

Tasks

Maze tasks have been constructed, their complexity has been defined by the number of possible paths starting from a choice point, and their respective degrees of difficulty have been determined (theoretically) by the length of the path, as well as (empirically) by the time required for solving the task. (Mazes were constructed by L. Fodor.)

According to the principles mentioned above, mazes varied along three levels of complexity. *Type A:* All of the paths conformed to a quadratic network; ramifications could only be orthogonal and the maximum number of paths connected to a choice point was 4. *Type B:* The paths could be inscribed into a triagonal network with

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Table I. Assessment data of mazes (solution times in seconds)

Level of complexity \ Level of difficulty	1	2	3
A	24	43	53
B	46	77	103
C	83	199	236

ramifications at 30° angles or its multiples; the maximum number of paths attached to one choice point was 6. *Type C:* A less rigid type allowing curved paths as well. For each level of complexity three grades of difficulty were provided by the different length of the paths to be followed and by the different number of choice points; thus, altogether nine mazes were used in the experiment. At the first grade of difficulty the length of the "adequate" path extended to 25, at the second to 50, and at the third to 75 units (choice points in the mazes are shown in Figure 1).

Empirical determination of average solution times for the mazes was carried out with 70 *S*s (aged 18–24 years, with an average of 21 years), all were university students, male and female, of whom three groups (with 20, 20, and 30 persons, respectively) were formed. Solution times (in seconds) for the mazes are summarized in Table I.

In addition to the time required for solution, the number of errors and the distance covered on the wrong path were also considered. The amount of time required for a solution increases, as it was expected, with the increase in difficulty and complexity. However, the most difficult mazes at a lower level of complexity and the least difficult ones at the next level of complexity, that is, pairs A/3–B/1 and B/3–C/1, require a similar amount of time to be solved (two-tailed t-tests comparing these pairs were nonsignificant). These pairs are close to each other regarding the number of mistakes and the distance covered on the wrong path as well. As a result of this "calibrating" experiment, the following two pairs of mazes were selected to be used in the experiment; A/3 and B/1, and B/3 and C/1 which proved to be equal in difficulty but different in complexity.

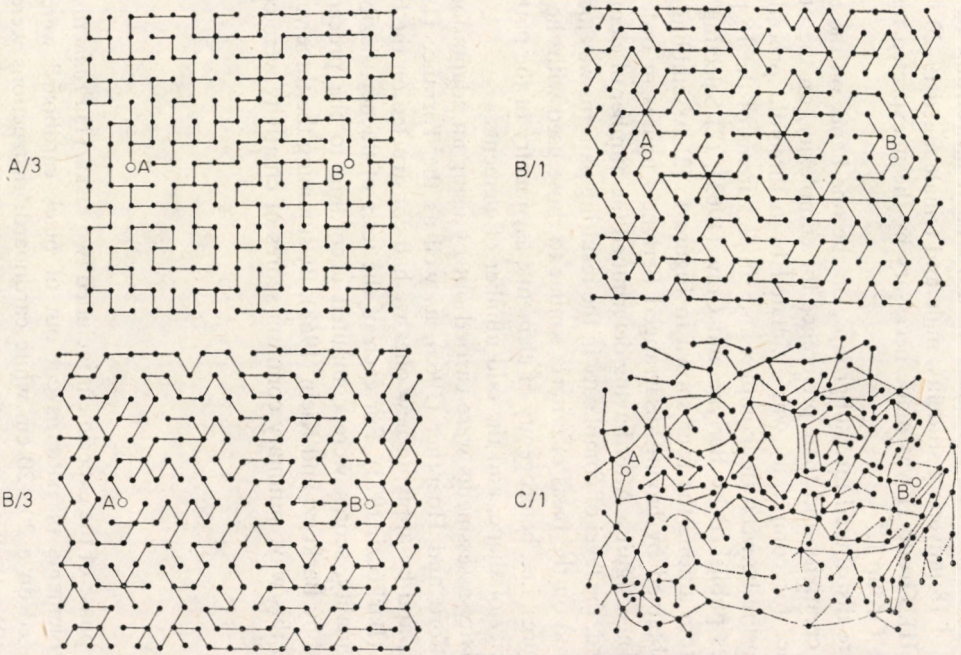

Figure 1. Mazes used in the experiment

Subjects

Experiments were performed with two samples of *S*s: one of 28 secondary school boys and girls, aged 16–17 years (Group I), and another of 18 university students. male and female, aged 19–20 years (Group II). Group II was made necessary by the unexpected results found in Group I.

*S*s were distributed into subgroups, on the one hand, on the basis of their creativity and their preference for complexity, on the other. Preference for complexity was estimated by a threefold procedure: (1) Choosing between the complex and simplex items of the 16 pairs of figures published by Berlyne and Craw (1963); (2) Selecting two mazes from among the four shown in Figure 1; (3) Assembling elements obtained by having disarranged Berlyne's figures in order to produce new figures. After having determined the number of elements to be used, the level of complexity in the resulting patterns was judged and scored on the basis of criteria similar to those used with the original figures, i.e., heterogenity of elements, asymmetry of the pattern, irregularity of shape, and the odd number of elements.

Creativity assessments were carried out by using an adaptation of the Guilford and Hoepfner (1965), as well as the Torrance (1968) methods, and by applying new ones we had constructed on the basis of these (Barkóczi, 1973). For each of the tests of fluency, flexibility and originality, scores were computed according to the procedure described by Barkóczi and Klein (1968). By summing the three values obtained this way, summary common scores of creativity were computed.

Procedure

The first phase of the experiment included two tasks. (1) *Production of figures:* Elements of patterns cut out of black cardboard were to be arranged on a 20×20 cm white cardboard. Instructions were as follows: "We shall give you figures and you are to arrange them in any way, to form whatever you like. You may use two to five elements." The resulting patterns were evaluated on the basis of the four aspects described above. The highest possible score was 8. Two

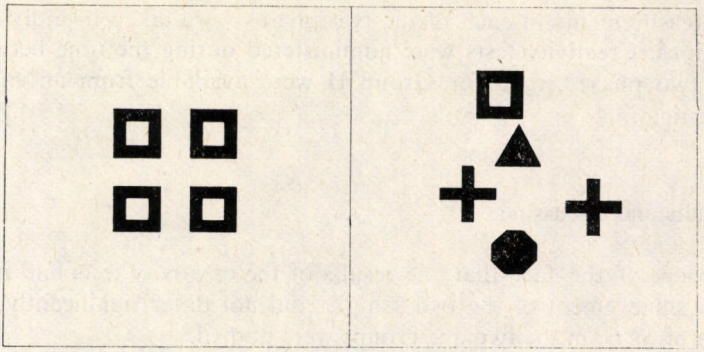

Figure 2. A simplex and a complex pattern constructed by the subjects

of the patterns constructed by the *S*s are shown in Figure 2. (2) *Choice: S*s were instructed as follows: "You will be shown pairs of figures. Please choose from each pair the one you prefer." The number of cases with a preference for complex patterns – a maximum of 16 – was recorded. Then the *S*s were asked to choose two of the four mazes. At this time, no *S* knew about the solution task to be faced later on in the second phase of the experiment.

The two choices among the mazes from A/3 to C/1 received scores from 1 to 4. A maximum score of 7 could be thus obtained. Analysis of the interrelations among the three preference indices had proved them appropriate and thus ready to be summed up in a general value. χ^2 computed from the contingencies between choice and construction of figures was $\chi^2 = 17.043$, $p < 0.001$ with a contingency coefficient of $c = 0.629$; χ^2 between choice of the most complex maze C/1 and that of figures resulted in $\chi^2 = 5.7302$, $p < 0.05$ with a contingency coefficient of $c = 0.365$.

The score for complexity preference of a given *S* was obtained as a sum of the three values described, with a maximum of (16 + 8 + 7) 31 points. Empirical values varied between 8 and 29, with an average of 18.39.

The second phase of the experiment, carried out three weeks later, included the solving of four maze tasks in the order of A/3, B/1, B/3 and C/1. The time required for the solutions was measured by a stopwatch.

Measurements in each of the two phases were taken in individual sessions. Creativity tests were administered during the time between the two phases; data for Group II were available from an earlier investigation.

Results and discussion

In view of the fact that the results of the creativity tests and maze task achievement of the two samples did not differ significantly, the data of *S*s from the two age groups were pooled.

In our investigation, no relationship between creativity and preference for complexity has been demonstrated (Spearman's $r_s = 0.146$, n.s.). Creativity values of complex- and simplex-preferring groups did not differ from each other. On this basis, *S*s were classified along the dimensions of creativity and complexity preference in the following way:

Complex-preferring (N = 22)	21– 28 points
Simplex-preferring (N = 24)	8– 20 points
Creative (N = 24)	100–186 points
Non-creative (N = 22)	52– 99 points

Groups were formed in the following arrangement: complex-preferring + creative (C-Cr), simplex-preferring + creative (S-Cr), complex-preferring + non-creative (C-NCr); simplex-preferring + non-creative (S-NCr). Average solution times of the mazes and results of an analysis of variance are presented in Table II and Figure 3.

Table II. Average solution times (in seconds) of the mazes in different groups and ANOVAs

Mazes \ Groups	C—Cr N = 10	S—Cr N = 13	C—NCr N = 12	S—NCr N = 11	Σ N = 46	F (3.42)	p
A/3	35.2	39.1	64.1	73.0	53.6	3.43	0.025
B/1	45.7	44.3	75.6	45.0	52.9	<1	n.s.
B/3	79.2	76.0	121.5	143.0	104.6	2.43	0.10
C/1	66.6	68.3	73.3	130.0	84.0	2.25	0.10

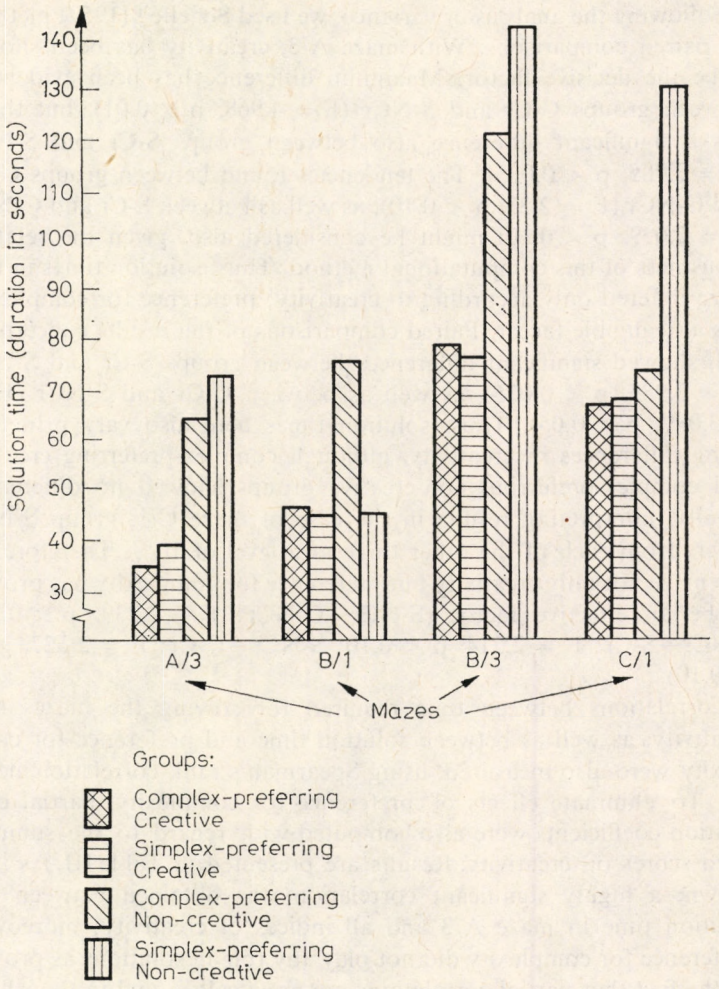

Figure 3. Average solution times of different types of mazes

The examined variables have a significant effect in the solution of maze A/3, absolutely none in the case of B/1, and only a nearly significant effect in the cases of B/3 and C/1.

Following the analysis of variance, we used Scheffé's (1959) method for paired comparisons. With maze A/3, creativity has been shown to be the decisive factor. Maximum difference has been evidenced between groups C-Cr and S-NCr ($F = 4.968$, $p < 0.01$), but there was a significant difference also between groups S-Cr and S-NCr ($F = 3.785$, $p < 0.025$). The tendencies found between groups C-Cr and C-NCr ($F = 2.33$, $p < 0.10$), as well as between S-Cr and C-NCr ($F = 2.059$, $p < 0.10$) might be considered also, given the relative robustness of this computational method. Thus, solution times in this maze differed only according to creativity; preference for complexity was a negligible factor. Paired comparisons of the results concerning B/3, showed significant differences between groups S-Cr and S-NCr ($F = 3.985$, $p < 0.025$), as well as between C-Cr and S-NCr ($F = = 3.089$, $p < 0.05$). Thus, solution times here also vary primarily along differences in creativity, although complex-preferring creative and complex-preferring non-creative groups showed no difference. Finally, interpreting results in the case of maze C/1, group S-NCr differs from each of the other three at a level of 10%. Therefore, in this maze not only creativity but preference for complexity has proved to be an effective factor (S-NCr – C-NCr: $F = 2.239$, $p < 0.10$; S-NCr – S-Cr: $F = 2.214$, $p < 0.10$; S-NCr – C-Cr: $F = 2.527$, $p < < 0.10$).

Correlations between time required for solving the mazes and creativity, as well as between solution time and preference for complexity were also measured, using Spearman's rank-correlation method. To eliminate effects of preference for complexity, partial correlation coefficients were also computed with regard to the summarized scores on creativity. Results are presented in Table III. As it is shown, a highly significant correlation was obtained between the solution time in maze A/3 and all indices of creativity; moreover, preference for complexity did not play any role in solutions as proved by the fact that partial correlations are practically equal to the whole coefficient. This result is corroborated also by data gained from the analysis of variance. Unambiguous results have been obtained in maze B/1 as well; neither creativity nor preference for complexity has shown any correlation with solution time when the analysis of variance did not reach significance. This does not hold, however, for maze B/3; although there were no significant correlations with the

Table III. Rank correlation coefficients between solution time of mazes and creativity, and preference for complexity

Mazes	Fluency	Flexibility	Originality	Σ Creativity	Complexity
A/3	0.476***	0.553***	0.550***	0.603*** 0.593***	0.188
B/1	0.111	0.122	0.003	0.130 0.004	0.182
B/3	0.191	0.129	0.251	0.186 0.170	0.130
C/1	0.461**	0.426**	0.465**	0.441** 0.326*	0.151

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$
Second numbers in the Σ Creativity cells are partial correlations.

indices examined, in the analysis of variance significant differences have been shown. Finally, solution of maze C/3 correlated with each of three creativity factors and, while having no significant correlation with preference for complexity, the latter is still supposed to have a certain influence on the solution. This might explain the decrease of the partial correlation as compared to the initial correlation. This is supported by the fact that, according to the ANOVA, group C-NCr and both creative groups performed on the same level. Being the most complex task, the solution in question is shown to be effected not only by creativity but by preference for complexity as well.

Our findings can be summarized as follows: *(a)* In this setting and arrangement, interrelations between creativity and preference for complexity could not be verified; *(b)* The effect of preference for complexity can be shown in the solution of the most complex maze, C/1; *(c)* Creativity is evidenced to have an unambiguous influence on the solution of the simplest maze, A/3, as well as the most complex one, C/1, while a certain difference could also be obtained in the case of B/3.

Distinguishing creativity from preference for complexity does not seem to correspond to the findings of Barron (1953, 1963). A possible reason for this can be found in our methods for the estimation of a preference for complexity, which differ from the Barron-Welsh Art Scale used by Barron (1963) in the experiment cited. Nevertheless,

preference for complexity and creativity do not appear to be unseparable; rather they are – according to our three-component measurement of preference, which seems to be suitably reliable – independent factors. While preference for complexity is primarily a motivational/attitudinal factor, creativity is a cognitive one, on the basis of our method of group selection. As far as later research is concerned, the simplex-preferring-creative group deserves special attention.

The dramatic superiority of creative persons in solving the simplest maze, A/3, was unexpected, surprising. As a possible explanation, the ability of creative persons to survey this task as a unit (perceive it as a whole) can be hypothesized. This hypothesis is corroborated by a result of Komlósi's (this volume) showing that a difference in recognizing tachistoscopically presented simple figures occurs between groups selected with the same (mostly verbal) types of creativity tests, favouring the more creative persons. Based on this, one may suggest that creative persons have an advantage in all kinds of (convergent or divergent) tasks requiring the integration of the constituents of a problem in a perceptual (maybe also symbolic) way.

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Ágnes Kovács and Csaba Pléh

The effects of anxiety, success and failure in convergent and divergent, verbal and figural tasks

The effects of general tension on human performance in different task situations have become a recurrent topic in experimental psychology since the early fifties. Relying on the Hull-Spence theory of motivation, the general level of tension was studied as a personality variable with the aid of the Manifest Anxiety Scale (Taylor, 1953). According to the expectations of the theory, anxiety enhances performance in simple tasks or learning situations where correct answers are due to great habit strength, while in difficult tasks (e.g., under increased possibility of interference), anxiety reduces performance by increasing the chances of "incorrect" answers also, in order to surpass the threshold. Relying on these ideas, numerous studies have proved that in simpler situations anxious subjects perform better indeed, while in more complicated tasks non-anxious subjects show the better performance, and these differences become even more expressed under the influence of external motivating factors (failure, threat) (for a summary see Taylor, 1956; Sarason, 1960). In this respect, one can disregard the much debated questions concerning the underlying theory and the measurement of manifest anxiety, namely, whether the effects are due to an increased general tension or to an increased susceptibility to motivating influences, and whether it is acceptable at all to treat anxiety as an undifferentiated concept.

On the basis of the task-dependent effects of anxiety, the purpose of our investigation was to see the influence of anxiety on convergent and divergent tasks, in terms of the Guilford model (1956, 1967). The basic questions and hypotheses were the following:

(1) Based on the interpretation of effects of the general drive level on performance in terms of an optimum level of motivation, an attempt was made to compare the optimal motivation level in convergent and divergent tasks. Since in studies on creativity indices of

originality by definition favour responses of low habit strength, it was supposed that divergent thinking, especially originality, has a lower optimal motivation than convergent thinking.

(2) An effort was made to compare the effects of drive level on performance in works with semantic and figural contents, as interpreted by Guilford (1967).

(3) What kind of interaction is there between the level of tension conceived as a personality trait and external motivation – success and failure – in determining divergent performance?

Two experiments were conducted for the analysis of these questions: in the first, verbal, in the second, figural tasks were used. Both experiments involved divergent as well as convergent tasks, and motivational level varied according to the scores of the Manifest Anxiety Scale, supplemented with external motivating interventions.

Experiment I: verbal tasks

Methods

Procedure and materials

The test was administerd in a classroom situation in two phases, with one week between the two sessions.

Phase 1. The teacher, who served as the *E*, had the students fill out a Hungarian translation of Taylor's MAS. Afterwards, *S*s had to solve the Superordinate Concepts subtest (subtest No. V) of the Hungarian version of the Wechsler–Bellevue intelligence test (Kun and Szegedi, 1971). While students worked in a self-timed manner on the anxiety questionnaire, the time allowed for solution of the above task, consisting of 12 word pairs, was 3 minutes.

The second task served two purposes: performance was evaluated as a characteristic convergent production and, at the same time, it enabled us to introduce external motivating variables in Phase 2. *S*s were given "marks" on the basis of their alleged performance in this task, independently of their actual performance, following Perron's method (1961). Students were told that their performance had been rated on a 1–10 scale, 1 meaning the lowest, 10 the highest

performance. Three groups were formed: the failure group ("marks" 1, 2), the neutral group ("marks" 4, 5, 6) and the success group ("marks" 9 and 10). Randomization was performed twice, once for grouping and once for marking.

Subjects were informed about their "performance" in the superordinate task on the personalized answer sheets used in Phase 2.

Phase 2. Two creativity tests were administered during this phase. One of them was Guilford's Unusual Uses test, with the usual instructions (6 items), the other was Barkóczi and Klein's (1968) Sentence Completion test, with the following instruction: "Your task is to complete these sentences in some bizarre, unusual way, and in as many ways as you can". Five simple sentences of the type "The old man along the road . . ." were used.

The two tasks were presented one after the other with 6 minutes completion time for each, but the time limit was not announced in advance by the *E*. In order to compensate for possible serial effects, in two classes the Unusual Uses test was given first while in two other classes the Sentence Completion test.

Preceding the solution of the first task, the *E* explained the meaning of scores on the answer sheets.

Subjects

121 graduating secondary school boys and girls (17–18 years of age) participated in the experiment, with 114 of them partaking in both of the phases.

Scoring principles and subgroups

Five groups were formed with the usual 20–20% divisions of the distribution of the *S*s' MAS scores (Taylor, 1956). Manifest anxiety score ranges for the subgroups were: 4–12: extremely non-anxious, 13–17: non-anxious, 18–31: moderately anxious, 22–27: quite anxious, over 28: very anxious. Overall mean was 20.1.

Results of the Superordinate Concepts test were evaluated according to the raw score conventions used in the Wechsler practice, which means that 3 levels of abstraction were distinguished, corresponding

to 0, 1, 2 raw points, in each task. Out of the possible 24, the overall mean in our sample was 16.5.

Three indices were used in both tests of creativity: *fluency* was represented by the number of adequate answers, *flexibility* by the number of answers belonging to different response categories, and, finally, *originality* was calculated according to the method devised by Barkóczi and Klein.

Results

(1) *Effects of anxiety*

In the *convergent task*, as illustrated in Figure 1, the classical inverted-U shaped relationship was found: a medium level of anxiety is

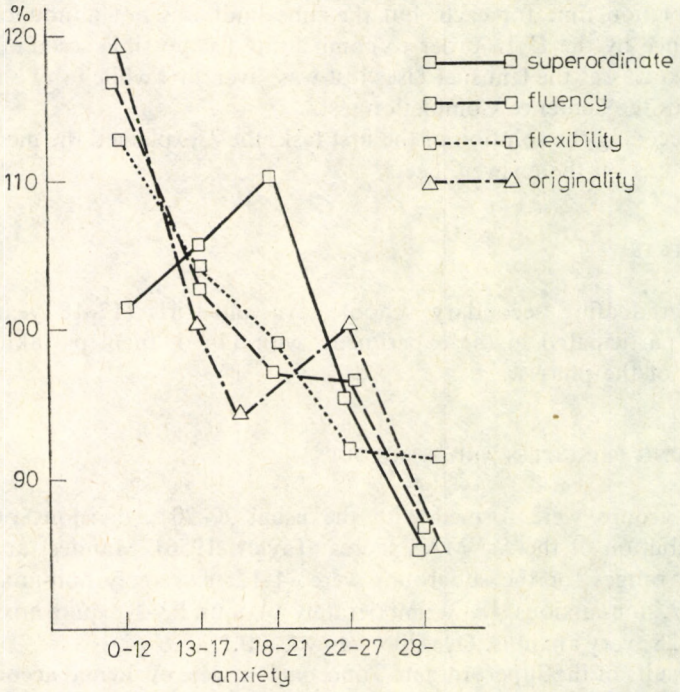

Figure 1. Effects of anxiety in the Superordinate Concepts and the Unusual Uses test

Table I. The effect of anxiety on creativity in the Unusual Uses test

	Fluency		Flexibility		Originality
	0—15	16—	0—14	15—	
Non-anxious n = 45	30	15	30	15	Sum of ranks = 444
Anxious n = 45	39	6	40	5	Sum of ranks = 546
Statistics p <	$\chi^2 = 3.988$ 0.05		$\chi^2 = 5.196$ 0.05		Mann–Whitney U-test 0.05

In the case of originality, only the two extreme (MAS under 12 and over 28) groups were compared.

accompanied by the best performance in this task. And non-anxious *S*s tend to perform better than anxious ones.

Of the two divergent creativity tasks significant differences due to anxiety were only found in the Unusual Uses test, as summarized in Table I. The differences indicate the expected direction: the non-anxious group or groups show a better performance in the indicators of creativity then the anxious ones.

Comparing the differences along anxiety with the ones obtained in convergent tasks, it can be seen that *while in convergent tasks an intermediate level of anxiety produces the best performance, with increasing anxiety performance gradually decreases.* Later on, in the Discussion, we will return to the question why this is true only in one of the two tasks.

(2) *Effects of external motivation on divergent performance*

Unlike the above effects of anxiety, the alleged "evaluation" of the Superordinate Concepts task had significant effects only in the Sentence Completion task. These are summarized in Table II.

Both types of external motivation increased flexibility compared to the neutral group, while originality was improved only by success. We will discuss the lack of differences in the Unusual Uses task later on.

Table II. Effects of external motivation in the Sentence Completion test

	Flexibility		Originality
	0–7	8–	Rank sums
Failure (n = 36)	13	23	2225.5
Neutral (n = 38)	19	20	2320.5
Success (n = 40)	9	31	2009

Success > Neutral	$\chi^2 = 4.516$ $p < 0.05$
Success+Failure > Neutral	$\chi^2 = 3.38$ $p < 0.05$
Success > Failure+Neutral	Mann–Whitney U-test $z = 1.732$ $p < 0.05$ (one-tailed)

(3) *Interaction between external motivation and anxiety in the determination of divergent performance*

External motivation had an effect on performance again only in the Sentence Completion test, in both the non-anxious and anxious groups (MAS 0 to 17, and over 22, respectively), as shown in Table III.

Table III. Effects of external motivation in the Sentence Completion test in anxious and non-anxious groups of subjects

	Non-anxious				Anxious		
	Flexibility		Fluency		Flexibility		Originality
	0–7	8–	0–9	10–	0–7	8	Rank sums
Success > Failure			5 7	16 4			300 n = 21 228 n = 11
			$\chi^2 = 3.33$ $p < 0.10$				Mann–Whitney U-test $p < 0.05$
Success+Neutral > Failure					5 4 8	16 10 3	
					$\chi^2 = 4.09$		$p < 0.05$
Success+Failure > Neutral	3 4 9	10 13 6					
	$\chi^2 = 4.612$ $p < 0.05$						

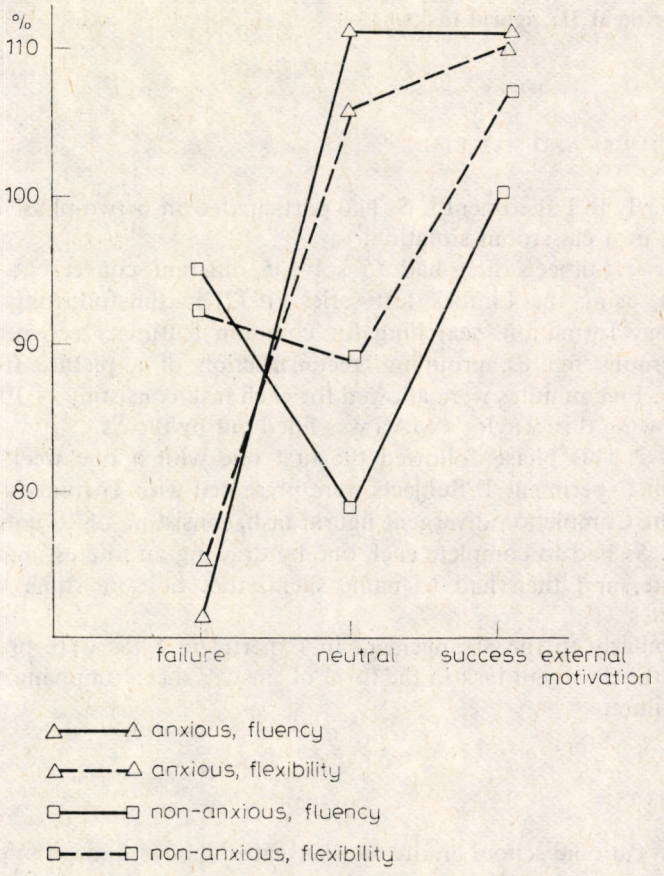

Figure 2. Effects of external motivation on the creativity of anxious and non-anxious subjects in the Sentence Completion test

On the basis of the data summarized in this Table and in Figure 2, one has the impression that *in non-anxious subjects any kind of motivating intervention tends to increase performance compared to the neutral situation, while in anxious subjects performance increases gradually from failure to success.* Reasons for this difference will be presented in the Discussion.

Experiment II: figural tasks

Methods

Procedure and materials

Similarly to Experiment I, *S*s had participated in a two-phase experiment in a classroom situation.

Phase 1. Subjects first had to solve 5 different convergent figural tasks, using the Limbek test series (1972) in the following order: analogy formation, searching for common features, recognition of congruous figures, grouping, reconstruction of a picture from its parts. Five minutes were allowed for each task consisting of 10 items. Following this, Taylor's MAS was filled out by the *S*s.

Phase 2. This phase followed the first one with a one week delay, like in Experiment I. Subjects were presented with Torrance's (1966) Picture Completion divergent figural task, consisting of 10 unfinished lines. *S*s had to complete each one by drawing an interesting object, picture, and then had to name them, too. Solution time was 10 minutes.

Similarly to the arrangement in Experiment I, *S*s were presented with the divergent task in the form of answer sheets implying success or failure.

Subjects

100 vocational school graduates (19-year-old boys and girls) participated in the experiment.

Scoring conventions

MAS values were grouped according to the conventions reported above. But group boundaries in this case had shifted towards higher absolute values. The five anxiety groups were the following: 0–15, 16–19, 20–23, 24–29, and over 30.

Every correct solution was given 1 point in the convergent tasks, thus, the possible score for each task ranged between 1 and 10.

In the Picture Completion task – as opposed to the verbal tests used in Experiment I – only originality was computed, while fluency and flexibility were not. A method devised by Torrance (1966) was used for this purpose, giving a score between 0 and 3 for each answer, on the basis of frequency. Relative frequencies were computed from this sample, and, as a measure of figural creativity, the overall (summed) originality score was used for each subject.

A 4-point scale was also used to evaluate the originality of the titles given to the drawings.

0 = generic names, e.g., ship, bowl;
1 = concrete descriptions, more differentiation, e.g., medieval ship, fruit bowl;
2 = descriptive title, rich in fantasy: the castle of a cruel but lonely lord; quivering birds fleeing from a cat;
3 = an abstract-symbolic, but adequate title: ear of the Earth; rebellion.

Results

1. *Effects of anxiety*

In convergent tasks the effects of anxiety were different from the ones in verbal tasks. As indicated in Figure 3, when results of the 5 tasks were summed, instead of an inverted-U shaped relationship, *the higher anxiety group showed a higher performance than the low-anxiety group.*

However, differences between the different tasks were rather great. Figure 4 and Table IV show, for one thing, that the general difficulty of the separate tasks was very different – most of the between-task comparisons were significant – on the other hand, anxiety did not have a uniform influence on performance in the different convergent figural tasks.

In the divergent task, the originality of the drawing increased with anxiety, as shown in Figure 5. With regard to the titles given to the drawings, however, medium level anxiety seems to produce the highest performance, although, as indicated in Figure 6, significant differences were obtained only when the medium anxiety group was compared with the rather anxious groups.

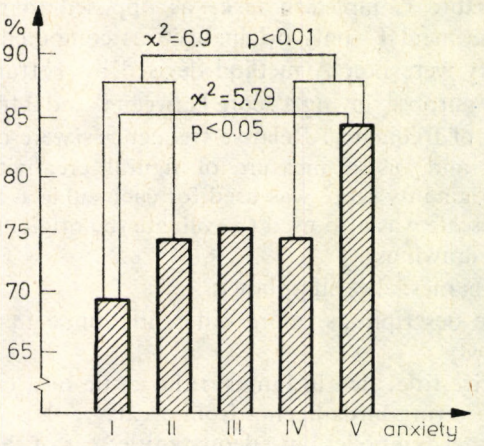

Figure 3. Effects of anxiety in convergent figural tasks (performance over 6 points in each task in each anxiety group is given in percent)

2. *Effects of external motivation* (success and failure)

In this experiment effects of success and failure were only studied in groups distinguished according to anxiety levels. These two types of motivating factors had a different influence on the originality of the

Table IV. Differences between the convergent figural tasks (comparisons of responses with over 8 points)

Tasks	Analogies	Looking for common features	Recognizing congruent figures	Grouping
Common features	$\chi^2 = 26.44$ $p < 0.001$			
Recognizing congruent figures	$\chi^2 = 47.12$ $p < 0.001$	$\chi^2 = 3.85$ $p < 0.05$		
Grouping	$\chi^2 = 24.92$ $p < 0.001$	$\chi^2 = 2.43$ n.s.	$\chi^2 = 4.51$ $p < 0.05$	
Construction of picture from elements	$\chi^2 = 10.58$ $p < 0.01$	$\chi^2 = 3.92$ $p < 0.05$	$\chi^2 = 14.97$ $p < 0.001$	$\chi^2 = 3.31$ $p < 0.10$

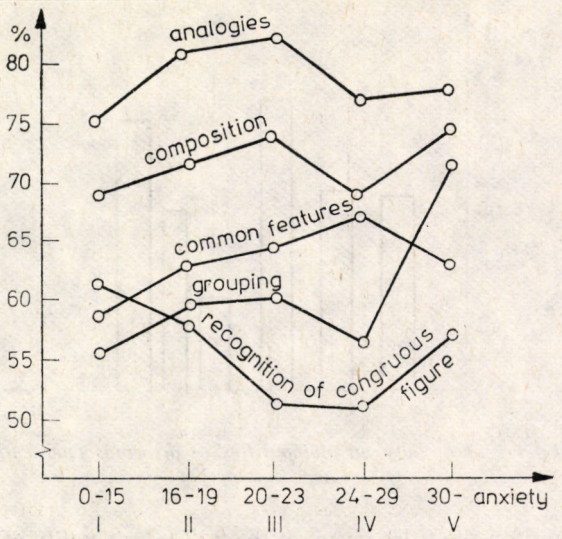

Figure 4. Relationship between anxiety and convergent figural performance in different tasks

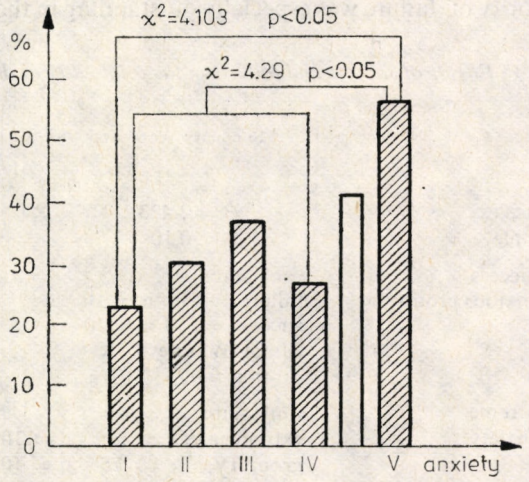

Figure 5. Effects of anxiety on the originality of the pictures (summed originality over 16 points in percent)

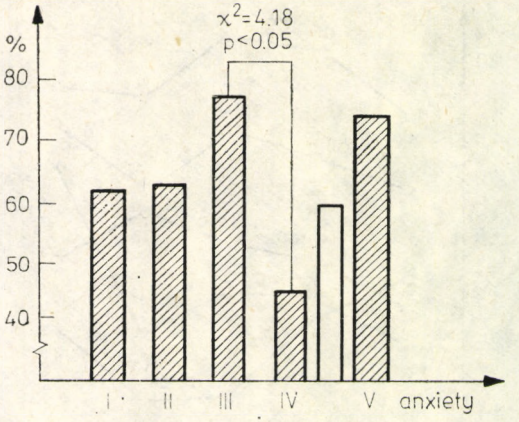

Figure 6. Effects of anxiety on giving titles to drawings (percentage of scores over 9 points)

pictures and on the titles given to them. *The originality of the picture was, in general, increased by failure.*

As indicated in Table V, failure, compared to success, had increased chiefly the frequency of the most original 3-point responses. The superiority of failure was especially outstanding in the group char-

Table V. Effects of success and failure on the originality of drawings

	Summary score over 16	Answers worth 3 points
Failure > Success in whole sample	$\chi^2 = 3.423$ $p < 0.10$	$\chi^2 = 5.041$ $p < 0.05$
Failure > Success in medium anxious group	rank sums failure = 136 n = 10 success = 74 n = 10 Mann–Whitney U-test $p < 0.05$	$\chi^2 = 4.453$ $p < 0.05$
Success in extreme anxious > anxiety group IV	rank sums extreme anx. = 135 n = 10 group IV = 75 n = 10 Mann–Whitney U-test $p < 0.05$	

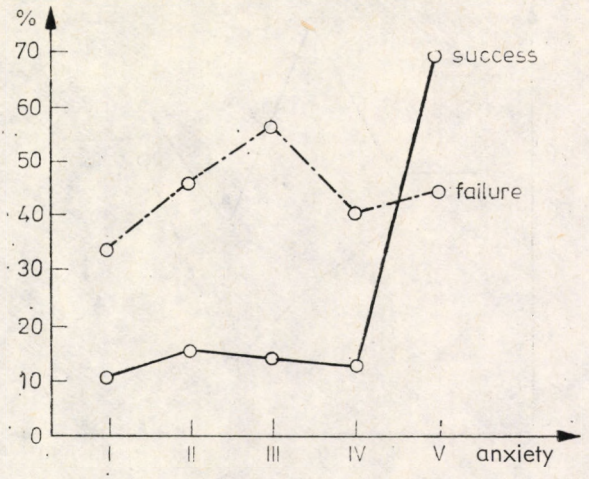

Figure 7. Effects of external motivation on the originality of the drawings (percentage of scores over 16 points)

acterized by a medium level anxiety. Success has been superior to failure only in the case of extremely anxious subjects.

Figure 7 also illustrates these relationships.

However, concerning the *titles given to the pictures*, success was always more influential than failure. According to Table VI, this was

Table VI. Effects of success and failure on naming pictures

	Summary score over 9	Number of answers worth 2–3 points
Success > Failure (whole sample)	$\chi^2 = 3.43$ $p < 0.05$	$\chi^2 = 18.624$ $p < 0.001$
Success > Failure in medium anxious group	rank sums success = 133 n = 10 failure = 77 n = 10 Mann–Whitney U-test $p < 0.05$	$\chi^2 = 11.183$ $p < 0.01$

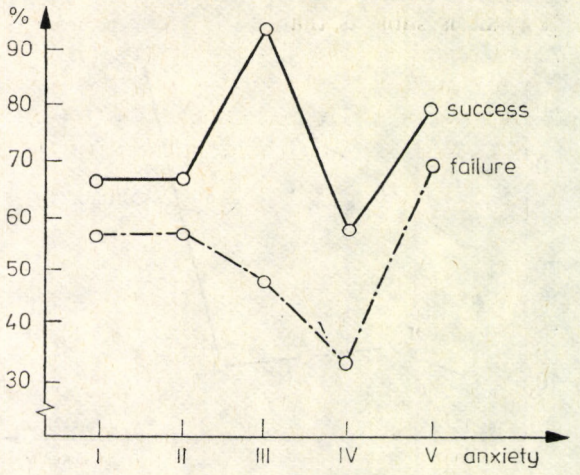

Figure 8. Effects of external motivation (success–failure) on giving titles to drawings (percentage of scores over 9 points)

especially true with regard to the most original titles (2–3 points), and it was the most remarkable in the group with medium level anxiety. It is of special interest that failure had the most remarkable effect on the originality of the picture itself in this very group!

When comparing the anxiety groups (see Table VII) it became apparent that success had a greater influence on the performance of

Table VII. Differential effects of success and failure on the naming of picture in different anxiety groups

Anxiety groups	Success
Medium anxious > Non-anxious	$\chi^2 = 5.432$, $p < 0.05$
Medium anxious > All anxious	$\chi^2 = 6.032$ $p < 0.05$
Extremely anxious > Rather anxious	$\chi^2 = 10.124$ $p < 0.01$
	Failure
Extremely anxious > Medium anxious	$\chi^2 = 3.440$ $p < 0.10$
Extremely anxious > Rather anxious	$\chi^2 = 7.312$ $p < 0.01$

moderately anxious subjects than on any of the others. But in the case of extremely anxious subjects, the level of performance in giving titles was raised equally by success and failure.

Figure 8 summarizes the differential effects of success and failure on the originality of the drawings and on their naming.

Discussion

Anxiety and external motivation had different effects in tasks requiring verbal-semantic performance and in those requiring figural performance, regardless of whether convergent or divergent thinking was required.

In convergent tasks, in the case of verbal tests, performance really followed the inverted U-shaped curve, so frequently referred to in the literature concerning optimum motivational levels. That is to say, subjects with a medium level of anxiety achieved the best results. In figural tasks, on the other hand, the increase of anxiety consistently improved performance level, the best convergent figural performance being given by the extremely anxious subjects. At the same time, the difficulty level of tasks within the convergent sphere was an equally important moderating factor here.

In divergent tasks, on the other hand, verbal tests seem to have a very "low level of optimal tension", especially in the comparatively more difficult tasks (in our case, this was the Unusual Uses test), and performance seemed to decrease together with the increase of anxiety. At the same time, in these tasks the effect of anxiety level cancelled any possible effects external motivation may have had. On the other hand, in the easier divergent verbal task of Sentence Completion, where less adaptation to the task is needed to produce acceptable solutions, external motivation had a characteristic effect. Success and failure both increased performance in non-anxious subjects. They seem to be "undermotivated" for this easy task. In the anxious group, however, under the influence of failure, performance decreased compared to the neutrally motivated subgroup, probably due to the tension rising above the optimum level. Success, in their case, may increase performance by decreasing the tension level of anxious subjects in easy tasks which do not necessarily raise the tension level.

The situation was radically different, however, in the case of divergent figural tasks. Generally speaking, tension – both anxiety and failure – tends to increase the originality of drawings. The originality of titles behaves in these tasks similarly as in verbal divergent tasks, showing a rather low level of optimum motivation.

It would be too adventureous to attempt a detailed interpretation of our results. The most general conclusion of our studies is that the tension level giving optimum performance depends not only on the convergent or divergent nature of the task, but also on its figural or verbal form, and its level of difficulty. In order to reveal the exact interactions among these three factors, further studies, using a wider repertory of tasks, are required.

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Ágnes Kovács

Creativity of associations given to complex and simplex figures in groups of different preference

The cognitive approach to creativity offers a great number of possible research directions. Our primary aim here is to reveal that particular *creative cognitive strategy* which can be recognized in perceptual stimulus selection, as well as in the features of processing and in response processes.

It has been verified in several experimental studies that creative people have an open, flexible *perceptual attitude* and are always ready to change their viewpoint. There is some evidence for their faster information processing and their ability to use information in elementary processes (Komlósi, this volume; Dénes, 1974).

The role of perceptual attitude is emphasized because it may characterize the personality and, as a general style of information processing, effect input encoding through the accessibility of categories used in recognition and in the interpretation of the stimulus (Bruner, 1957).

A kind of readiness to select certain stimulus patterns is studied by the *investigation of preferences* that indicate attraction to and avoidance of certain kinds of stimuli.

Evidence concerning relationships between *preference and creativity* is rather contradictory, and this state of affairs motivates further clarification of the complexity of the problem.

Concerning preference of complex and simplex figures, Barron and Welsh (1952), and Barron (1953) found that complexity preference correlates with originality ($r = 0.40$) and aesthetic judgement ($r = 0.44$). The complex person's thinking is more flexible, as the -0.35 correlation with rigidity indicates (Barron, 1953). The simplex person, on the other hand, is characterized by a preference of symmetry and regularity that is correlated with the person's stability and balance.

Munsinger and Kessen (1964) studied preference for random polygons. It was found that non-artists preferred moderately complex polygons, while in the case of students of fine arts preference was proportionate to increasing complexity. They propose that during cognitive processes uncertainty arises in response to the complex stimulus. Since artists have much greater previous experience concerning various form configurations, they have developed special *coding systems* which can reduce cognitive uncertainty during processing. It is claimed that a greater visual experience has a favourable effect on the tolerance of all inconsistencies.

In an experiment with mazes of various complexity, Barkóczi, Büchler and László (this volume) found no relationship between complexity preference and creativity. Creative and non-creative people could not be distinguished among the subjects with extreme preference of complex or simplex figures. According to them, complexity preference is predominantly a *motivational* factor, while creativity is a *cognitive* factor, and the two are independent of one another.

Barron, too, had pointed out that a personality showing extreme preferences might have efficient as well as inefficient aspects, and we believe that this is due to the more salient role of cognitive factors.

We have found in our own experiments as well (Kovács, 1980) that the subjects' performance on creativity tests was not affected by their preferences. Correlation between complexity preference and visual originality was 0.0048, and between complexity preference and originality on verbal tests it was 0.165. Our groups, considered homogeneous with respect to preference, included persons with high and with low creativity.

The studies mentioned above were concerned only with possible relationships between preference and creativity, without offering a deeper insight into *the organization of creative responses*. They went no further than the evaluation of responses and they did not search for a *creative strategy of response production*. In fact, when a stimulus is presented, cognitive structures underlying memory are activated and the recall of a response is realized in the retrieval processes. Preference of a stimulus pattern is affected – besides motivational factors – by *cognitive* aspects, such as the physical or semantic level of coding, mentioned by Craik and Lockhart (1972), involved in the processing of signals.

The importance of semantic features is emphasized, for example, by Vanderplas and Garvin (1959a, b), who found better performance on figures with a higher association value in a recognition task. Richness of associations turned out to be especially important in the case of complex figures.

Concerning associations given to simplex and complex figures, there is some evidence suggesting differences in their processing. Czigler (1973) had found that associations concerning complex figures are more diverse, their coding is more variable, and presumably they are mapped or stored in memory along several features.

To approach the complexity of semantic information processing more closely, we have attempted to consider creativity aspects in a *qualitative classification* of free associations given to figures. By evaluating the level of originality, our aim was to provide new possibilities for discovering differences in the processing of complex and simplex figures on the one hand, and, on the other, to obtain some evidence concerning relationships between perceptual attitude and choice strategy on the basis of the originality level of associations given by groups with different preferences.

The fundamental *hypotheses* of our investigation were the following:

1. It was assumed that groups showing extreme (complex-simplex) preferences differed with respect to the creativity of associations given to the figures.
2. Comparing the originality of associations given to complex and simplex figures, a higher percentage of low originality responses was expected to simplex figures. It was supposed that these responses correspond to the large quantity of geometrical-technical associations given to simplex figures, as reported by Czigler (1973), and these types of associations, which are very popular and frequent, were considered to have low originality value. Such responses were expected to appear less frequently in the case of complex figures.
3. Finally, comparing two secondary schools – one specialized in fine arts, the other with no such specialization – it was expected that the artists would give more responses of high originality value.

Methods

The investigations were carried out in four 2nd-grade classes of a general secondary school ($n=95$) and in four 1st-grade classes of a secondary school of art ($n=105$). Subjects were girls and boys of 15–16 years of age.

Study of complexity preference

The Revised Art Scale of Barron and Welsh (1952) was used. Subjects were given 86 cards with figures on them with the instruction: "There are figures on the cards. You are expected to indicate for each card whether you like it or not. After you have decided, write the number of the card either in the 'like' column or in the 'dislike' column on the response sheet."

Association task

Subjects were required to give associations for one minute to each of the 5 complex and 5 simplex figures included in the preference scale. The figures and the response sheets were presented in the form of a booklet with the following instruction: "We would like to know with the help of this experiment how many words come to your mind about these figures within a short period of time. You are expected to write down, one under the other, as many words as you can on the response sheet. The words may stand for things, ideas, events, places, or anything that the figure evokes in your mind. It is important that you take a look at the figure every time you have written down a word, because it is the words evoked by the figures we are interested in. Try to think of interesting things. Work fast, because you have only one minute for each figure. I will always tell you when to go on to the next picture."

The complex and simplex figures were presented in a random order.

Indices. Methods of scoring

1. Scoring of complexity preference

Each complex and simplex figure is worth one point in the evaluation of the Revised Art Scale of Barron and Welsh (1952). The authors compute complexity preference as a sum of the scores of liked complex and disliked simplex figures. In our opinion, however, the liking of complex figures and the dislike of simplex ones, cannot be regarded as a unitary process, hence it does not seem very suitable to assess preference by summing scores implicating two different processes. Our counterarguments are supported by the fact that the extent of complexity preference remains implicit in the total score, since attraction to less or more complex figures may result in the same total score, given an appropriate number of disliked figures.

Therefore, only the "like" responses were considered in the computation of preference value, involving the number of complex and simplex figures chosen by the subjects. The underlying hypothesis was that people preferring complex figures tend to like complex figures and to dislike simplex ones, while it is the other way around for people preferring simplex figures.

Relying on the above considerations, a rank order was constructed according to the "like" choices in order to establish extreme preference groups. The number of liked simplex figures was subtracted from the number of liked complex ones, thus giving a descending rank order of complexity preference. This score starts from the maximum choice of complex figures (+30 points) with a turning point at zero which indicates an increasing choice of simplex figures, and with a negative sign reaching its maximum at (−30).

	General secondary school (n = 95)	Secondary school of art (n = 105)
Complex preference	25–13 (n = 15)	27–14 (n = 18)
Average preference	3–(−3) (n = 14)	3–(−3) (n = 16)
Simplex preference	(−11)–(−25) (n = 11)	(−6)–(−20) (n = 12)

One average and two extreme preference groups were formed in each of the two schools.

The score range and the number of subjects in each group are shown above.

2. Evaluation of associations given to complex and simplex figures

The associations given to figures were interpreted as a sort of creativity task. We think that in an open, free situation the figures can evoke an infinite number of associations, which means that there is no single good solution. This task thus has the basic properties of a creativity task.

In evaluating the responses the same procedure was followed as in the scoring of creativity test. All three indices were used.

Fluencv: number of associations given to the figures.

Flexibility: number of the different response categories the associations belong to.

Originality: rareness of the associations. Infrequent occurrence of responses in the population studied.

To determine originality scores, a scoring system of our own was developed for each figure (on the basis of all 5,785 responses in the population) on the basis of Barkóczi and Klein's (1968) "refined" scoring technique. This scoring is "sensitive to the degree of originality of the given response, ranges from 0 to 1, takes advantage of the range, having repeated the investigation with n times greater number of subjects, the index remains essentially unchanged" (Klein, 1970).

A two-fold grouping of the associations belonging to the figures was performed: (a) according to thematic domains, i.e., categories, and (b) within these domains those responses were combined which agreed word for word, or showed only a slight difference. (Responses were classified by four independent judges.)

The formula for the computation of the originality score according to Klein (1970) is as follows:

$$k = \left(1 - \frac{I + i}{2T}\right)^{14}$$

where T = total number of responses
I = number of responses within a single domain
i = number of identical responses.

Associations given to complex and simplex figures were processed in one of two ways:

(a) The associations given by groups of different preference were compared, specifically, the subjects' *total scores* were compared with respect to fluency, flexibility and originality. A two-tailed *t*-test was used. Total score serves only as a *quantitative index* in this computation, expressing only the subject's achievement based on his/her associations. It does not show the *quality* of the responses, the level of originality of the responses, the degree to which the person "tends to give original responses". A certain total score can be achieved either as a sum of very high and very low originality scores, or as a sum of exclusively average originality scores.

Qualitative distinctions between the originality levels of associations were considered as important, therefore, a certain kind of grouping was developed on the basis of the scores of each response.

Three groups were formed: responses with scores ranging from 0.7 to 1.0 were regarded as *high originality associations*, those between 0.3 and 0.69 were regarded as *average originality associations*, and those ranging from 0.0 to 0.29 were regarded as *low originality* responses.

(b) Frequencies of the "qualitative" groups formed in the above discussed way, were also compared by using χ^2 tests with respect to groups of different preference.

Results

1. *Analysis of associations given to complex and simplex figures on the basis of total scores*

Comparisons according to creativity indices of associations are shown in Table I.

In the results of the general secondary school groups a significant difference was found between the groups of different preference regarding both the complex and the simplex figures. Subjects of *average preference* were found to be superior on all three indices.

Table I. Comparison of associations given to complex and simplex figures in the different preference groups

General secondary school	Average–Complex preference t	Complex–Simplex preference t	Average–Cimplex preference t
Complex figures			
Fluency	−1.22	2.14*	2.74**
Flexibility	−1.35	1.8	2.68**
Originality	−1.5	2.45*	3.09***
Simplex figures			
Fluency	−1.4	2.22*	3.43***
Flexibility	−1.02	2.73**	2.71**
Originality	−1.2	2.77**	3.0***
All figures			
Fluency	−1.36	2.25*	3.19***
Flexibility	−1.21	2.15*	2.79**
Originality	−1.38	2.75**	3.1***
Secondary school of art			
Complex figures			
Fluency	0.42	−1.09	−1.19
Flexibility	0.56	−0.97	−1.21
Originality	0.16	−1.07	−1.04
Simplex figures			
Fluency	−0.39	−1.3	−0.78
Flexibility	−0.03	−1.67	−1.29
Originality	−0.52	−1.38	−0.78
All figures			
Fluency	−0.02	−1.23	−1.03
Flexibility	0.2	−1.29	−1.26
Originality	−0.2	−1.26	−1.0

* = $p < 0.05$ ** = $p < 0.02$ *** = $p < 0.01$

Table II. Comparison of association values of the different preference groups in the general and the art secondary schools

	Complex–Complex preference t	Average–Average preference t	Simplex–Simplex preference t
Complex figures			
Fluency	−0.39	1.15	−2.44*
Flexibility	−0.74	1.14	−2.51*
Originality	−1.25	0.44	−2.86***
Simplex figures			
Fluency	0.56	1.43	−3.06***
Flexibility	0.66	1.37	−3.02***
Originality	−0.07	0.38	−2.11***
All figures			
Fluency	0.15	1.33	−2.79**
Flexibility	0.05	1.32	−2.8**
Originality	−0.66	0.42	−3.08***

* = $p < 0.05$ ** = $p < 0.02$ *** = $p < 0.01$

They gave the greatest number of associations, and their responses turned out to be the most fluent, flexible and original, too. A significant difference was found between the average preference groups and the *simplex preference* groups, with the latter giving the lowest level of performance concerning both complex and simplex figures (see Table I). With respect to simplex figures, even the *complex preference* group outperformed them.

Thus, concerning the associations given to the figures, it may be observed that a perceptual attitude with equal attraction towards average, complex and simplex figures proved to be the most efficient in the general secondary school group. Preference of simplicity yielded very few associations and they remained on the level of popular, high frequency responses. Complexity preference yielded average results on all three indices.

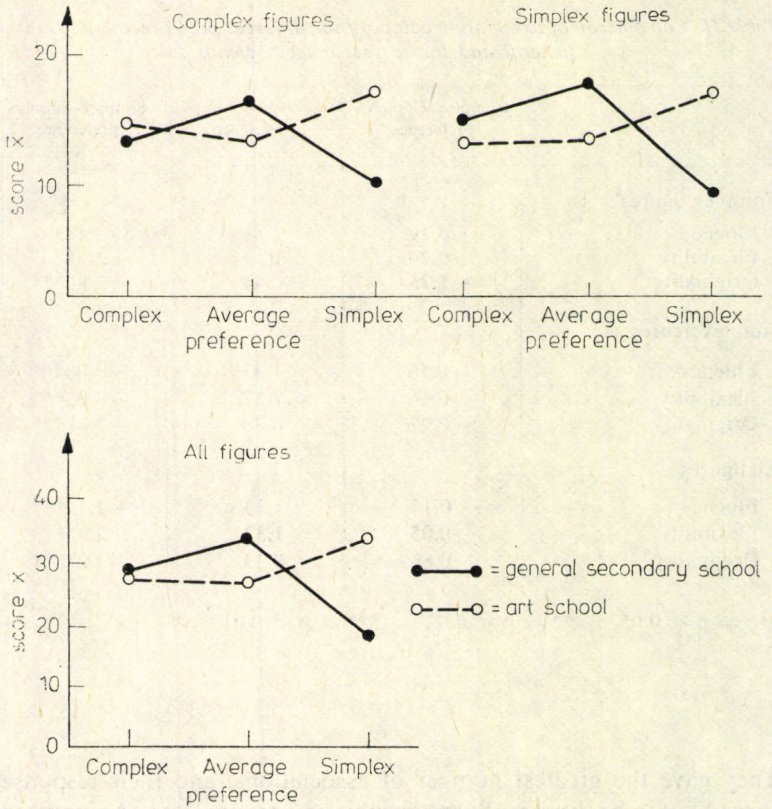

Figure 1a. Mean values of fluency

No significant difference was found between the groups of different preference in the *art school*. Their performance is on a similar level, though the best results were obtained from the *simplex preference* group as shown by their associations given to the complex and simplex figures.

Figure 1 illustrates the mean values of the indices of creativity of associations for both types of secondary school.

Significant differences were found only in the case of the simplex preference groups when the two schools were compared with regard to preference. The results of two-sampled *t*-test are shown in Table II.

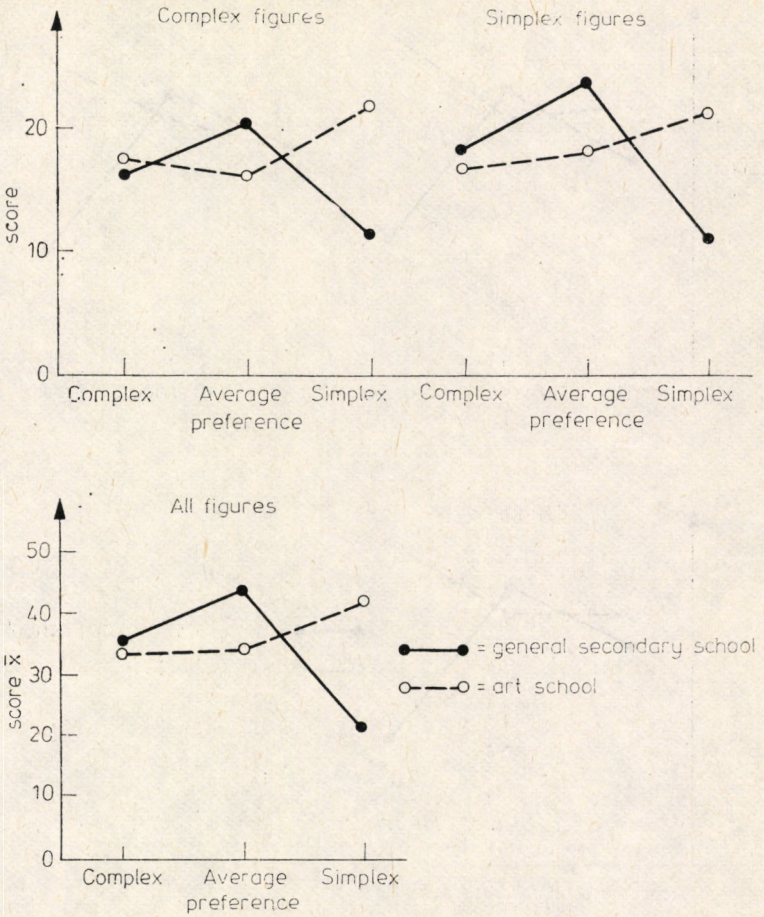

Figure 1b. Mean values of flexibility

Thus, we may say that our subjects were not effected by preference in their performance on associations to complex and simplex figures. The only exception was the simplex preference group. Simplex preference subjects from the art school gave more original associations belonging to various categories, while those from the general secondary school produced only the usual, high frequency responses.

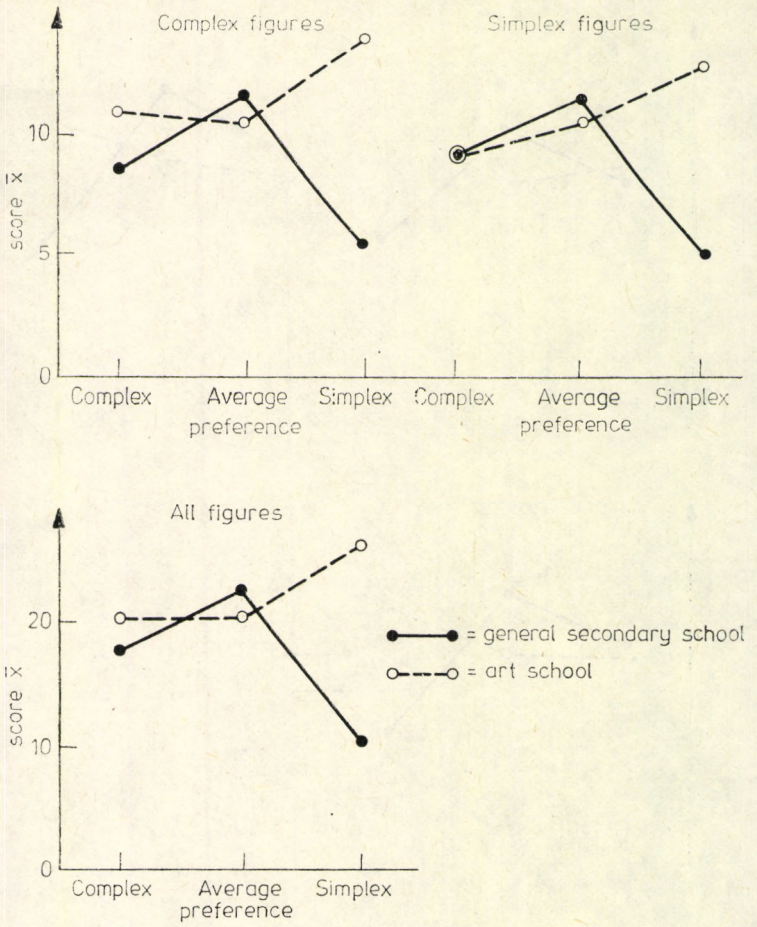

Figure 1c. Mean values of originality

2. *Analysis on the basis of high, average and low originality associations*

Results concerning the associations of groups of different preference are shown in Figure 2.

Table III shows the comparisons of associations of high, average and low originality of the different preference groups.

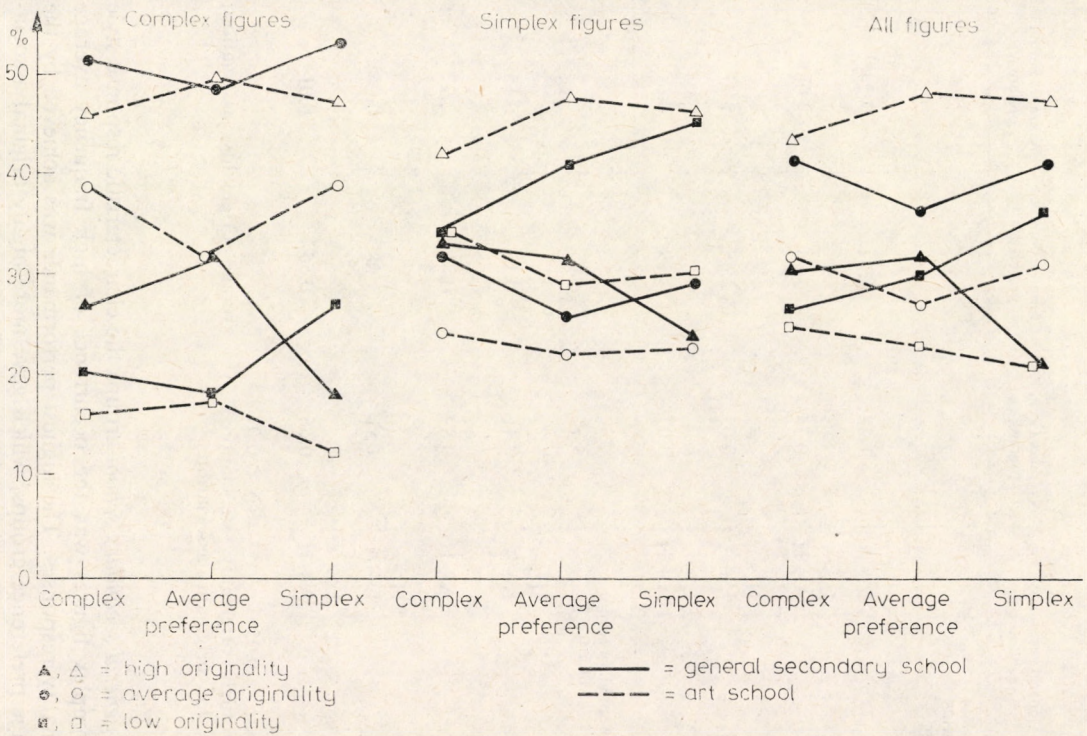

Figure 2. Low, average and high originality associations of different preference groups

Table III. Comparison of associations of different levels in the different preference groups

General secondary school		Average–Complex preference	Complex–Simplex preference	Average–Simplex preference
Statistics		χ^2	χ^2	χ^2
Complex figures	H> L+A	1.38	3.22	7.24**
	L> A+H	0.34	2.24	4.06*
Simplex figures	H> L+A	0.03	2.68	2.41
	L> A+H	3.07	4.19*	0.6
Secondary school of art				
Complex figures	H> L+A	0.41	0.12	0.15
	L> A+H	0.89	0.46	2.37
Simplex figures	H> L+A	1.51	1.08	0.06
	L> A+H	0.66	0.55	0.01

* = $p < 0.05$ ** = $p < 0.01$
H = high originality association; A = average originality association; L = low originality association

In *general secondary school* groups the characteristic response style to complex figures was the occurrence of high frequency average originality responses. The highest performance was achieved by the average preference groups, which gave more highly original associations than any other group (Average–Simplex: $\chi^2 = 7.24$, $p < 0.01$). The overall low performance of the simplex preference group was due

to the high frequency of popular responses (Average–Simplex: $\chi^2 = 4.06$, $p < 0.05$) which, due to their high habit strength, have displaced the rare and highly original responses.

In the case of *simplex figures*, on the other hand, high frequency and low originality responses were characteristic. This was found to hold particularly for simplex preferents. The complex and average preference groups showed a more balanced performance.

Results of *art school* subjects were not affected by preference. Responses of high, average and low originality and equally high frequency responses were given to complex and simplex figures, while simplex figures tended to evoke high frequency, popular responses in these groups, too.

When the *results of the two secondary schools* were *compared*, a crucial difference was found for the occurrence of high originality responses. Highly significant differences were obtained both for complex and for simplex figures when the various preference groups were compared. The results are summarized in Table IV.

There was a rather large number of high originality associations in the art school subjects' superior performance in the case of complex and simplex figures. A more superficial response style was found in the general secondary school, yielding a much greater number of high frequency associations.

Table IV. Comparison of the different preference groups of the two secondary schools concerning high, average and low originality responses

Preference		Complex–Complex preference χ^2	Average–Average preference χ^2	Simplex–Simplex preference χ^2
Complex figures	H> L+A	20.84***	14.42***	28.32***
	L> A+H	3.11	0.02	12.39***
Simplex figures	H> L+A	5.33*	13.65***	16.37***
	L> A+H	0.18	8.25**	8.71**

* = $p < 0.05$ ** = $p < 0.01$ *** = $p < 0.001$

Table V. Comparison of associations to complex and simplex figures in the two schools

	Complex figures General–Art secondary school	Simplex figures General–Art secondary school
H> A+L	$\chi^2 = 57.15$ $p < 0.001$	$\chi^2 = 31.51$ $p < 0.001$
L> A+H	$\chi^2 = 8.7$ $p < 0.01$	$\chi^2 = 12.35$ $p < 0.001$

H = high originality association; A = average originality association; L = low originality association

The results of the two secondary schools were also compared *without regard to preference*. The data are shown in Table V and Figure 3.

Skill turned out to be one of the most important factors among those that affect the originality of associations given to the figures. Those people who, owing to their education, have more varied experiences concerning such figures, are more likely to activate highly original associations, than those without experience in this strategy.

Comparing the results obtained for complex and simplex figures, it was found that the originality of associations was not affected by the nature of the figure. Highly original responses are equally likely for both complex and simplex figures. Low originality, popular responses are expected to a greater extent in the case of simplex figures. These results are summarized in Table VI.

Table VI. Comparison of data obtained for complex and simplex figures

	General secondary school Complex–Simplex figures	Secondary school of art Complex–Simplex figures
H> A+L	$\chi^2 = 1.46$ n.s.	$\chi^2 = 0.79$ n.s.
L> A+H	$\chi^2 = 57.2$ $p < 0.001$	$\chi^2 = 56.29$ $p < 0.001$

H = high originality association; A = average originality association; L = low originality association

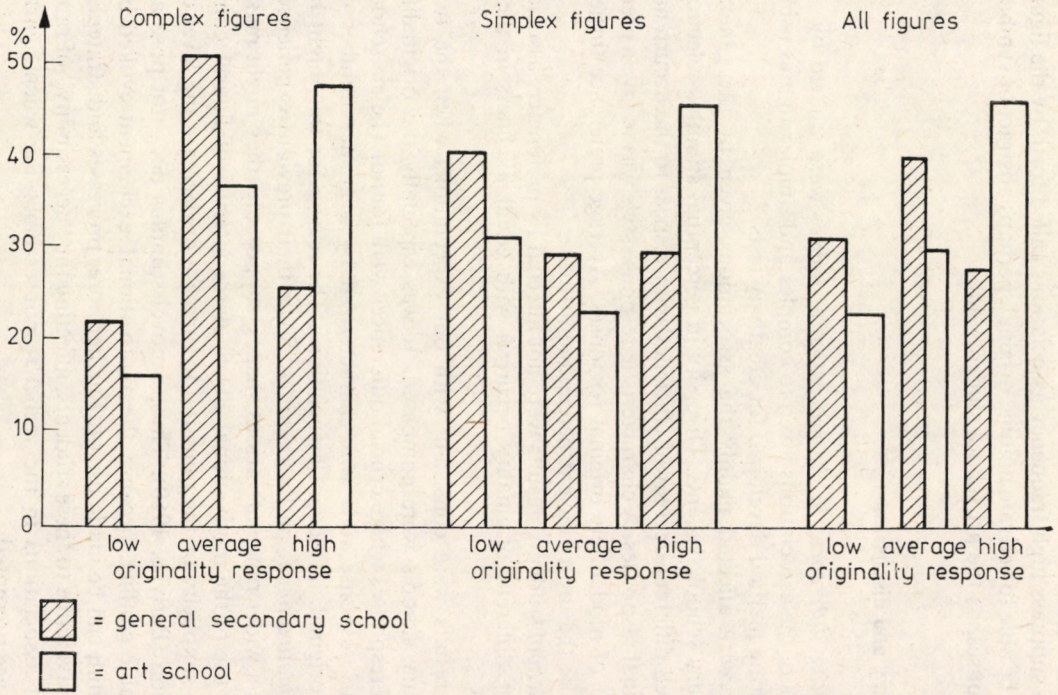

Figure 3. Distribution of associations of high, average and low originality among complex and simplex figures

We regard the differences between figures as important because they suggest that in associations to simplex figures it is crucial to be able to suppress high frequency associations called forth by the figure and to be able to activate unique, original, perhaps abstract or symbolic responses, as the art school students did.

Summary and discussion

Qualitative differences in the processing of figures were studied by an analysis of the associations given to complex and simplex figures using the scoring method developed for creativity tests.

Preference affected mainly the associations given by the general secondary school students. Diversity in perceptual stimulus selection indicated different degrees of efficiency with respect to the occurrence of original responses. A characteristic response style was to give a great number of moderately original responses. Average preference turned out to be the most efficient perceptual attitude.

Art school students' results were not affected by preference, associations of different originality occurred with equal likeliness in their responses.

The results were consistent with our expectations when the two secondary schools were compared. It was especially the originality level of responses where crucial differences were found. The art school students' response style was characterized by a greater number of highly original, infrequent associations. The reason for this might be partly *motivational*, partly *cognitive*. Since their previous experiences include a wider range of various shapes, supposedly, they might make greater use of the motivational effects of the interval of figural complexity–simplicity of the potential to increase or decrease the level of activation (Berlyne, 1960). Thus, a novel stimulus does not pose an unsolvable conflict, because the motivational excitement evoked by the stimuli can be made use of. Furthermore, processes and strategies may be available to these students, affecting the "accessibility" of rare, original associations in the verbal responses emerging when figural stimuli are presented.

Nearly the same number of associations were given *for complex and for simplex* figures, as it is shown by the fluency values. The number of

different categories used, i.e., the fluency of associations, was also similar in the case of complex and simplex figures.

A characteristic difference was found, however, in the originality of associations. Although the occurrence of highly original associations was equally likely for complex and simplex figures, low originality popular responses – consistently with our hypothesis – were more frequent for simplex figures. This result is in agreement with Czigler's findings (1973).

Thus, the character of the figure is an essential factor that poses a special problem for the subject in an association task. Are we able to suppress highly frequent and habitual associations when presented with a simplex figure and can we efficiently activate rare and original responses in the response competition?

Within the simplex preference group the results of our two secondary schools provide examples for both solutions. The simplex preferent subjects from the art school do have this ability, as the originality of their associations prove. Thus, there exists *creativity accompanied by simplex preference* that is manifested in abstract, symbolic responses involving a "verbal complexity" exceeding figural simplicity.

This result drew our attention to an extraordinarily exciting issue, namely, to the relationship between figural simplicity and verbal complexity, which is to be dealt with in further experiments.

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Tamás Zétényi and Dénes Lukács

Masculinity/femininity, perceptual style and creativity

Data reported on differences in creativity between males and females are highly contradictory. On the one hand, there is a general assumption that sex differences in performance on creativity tests do not exist. Hargreaves and Bolton (1972), Wallach and Kogan (1965), and Ward (1968) were all unable to find statistically significant differences on measures of creativity. Several other authors, however, have found a well-documented superiority of girls in verbal creativity (Bhavnani and Hutt, 1972; Olive, 1972; Torrance and Aliotti, 1969). Moreover, Raina (1969) found that boys excelled in all figural measures of the Torrance Tests of Creative Thinking.

Masculinity/femininity and creativity

Studying the relationship between creativity and various personality traits, several authors have found high creativity to presuppose independence and sensitivity. These traits, however, are known to correspond to opposite psychosexual roles in our cultural tradition. Males are expected to be more independent, and females to be more sensitive. Maybe Heim (1970) expressed most clearly the idea that "the creative man – in whatever field – tends to have more femininity in his psychological make up, than has the less creative man, and that the creative woman tends to possess more masculine traits than does the less creative woman" (p. 139).

This notion has received empirical support from the studies of Torrance (1963), Barron (1958, 1963), MacKinnon (1962), and others. Each of the authors conceded that the cross-gender identification of highly creative persons does not indicate homosexual tendencies.

Perceptual style and creativity

Most works concerning creativity assert that creative persons accept openness, as well as ambiguous situations. New stimuli are approached by such persons without definite expectations or preconceptions, and this type of openness enables them to obtain more and/or different information (Barron, 1958; Bloomberg, 1971; Golann, 1963; Komlósi, this volume).

On the basis of the above facts one could easily form the impression that creative individuals are characterized by such perceptual styles as field-independence, flexibility or complexity preference. A direct relationship between scores on creativity tests and any of the above-mentioned variables was, however, found only in a few of the studies (Dénes, 1977; Komlósi, this volume). No such relationship, or only some tendencies were obtained in the studies of Barkóczi *et al.* (1977), Brieri *et al.* (1958), Getzels and Jackson (1962), Gorman and Breskin, (1969), Rouse (1963), and Zétényi (1974).

A further contradiction among the data surveyed is indicated by the fact that groups of highly rigid, simplex-preferring or field-dependent persons have frequently included subjects showing creativity scores well over the average. None of the above studies had looked for potential differences between the sexes. The majority of authors seem to have been tempted by deceptive analogies to handle perceptual styles earmarked "advantageous" from the viewpoint of creativity as homogenous variables, independent of sex roles.

Perceptual styles and psychosexual identification

Comparing the scores on special tests (Rod and Frame; Embedded Figures Test) considerable differences have been found between males and females by Brieri *et al.* (1958), Chateau (1959), Miller (1953), Vaught, (1965), and Young (1959); males were found to be the more field-independent.

On the other hand, Breskin (1968) found significantly higher rigidity in college males by his Non-Verbal Rigidity test. According to the data of Witkin *et al.* (1962), field-independents are found among females as well, and Vaught's (1965) explanation for this finding suggests a shift towards masculinity in these females.

Psychosexual characteristics of perceptual style were also discussed by Erikson (1966, 1970). In his investigations with children he had observed that girls tended to prefer the protected well-defined areas in the space provided for building their "own world", while boys appeared to strive to fill the entire field.

According to our hypothesis, (1) it is the group of subjects showing cross-gender identification, who are able to become detached from earlier experience concerning the given stimuli, and are therefore able to process stimuli in a more independent, more differentiated, more complex way; (2) this group of subjects will show higher scores on creativity tests.

Methods

Subjects. A total of 396 *S*s (291 females and 105 males) between 18–25 years of age, all applicants to the university taking the psychology entrance examination, were studied. Data were collected in two groups: Group I included 202 *S*s (143 females and 59 males), Group II included 194 *S*s (148 females and 46 males).

Method A

For measuring masculinity/femininity, the Mf scale of the MMPI (Hathaway and McKinley, 1951) and, in addition, in Group II the Fe scale of the CPI (Gough, 1957) were computed from the CPI/MMPI answer sheets filled out as part of the aptitude and personality testing session of the entrance examination. To check our hypothesis concerning the processing of perceptual units, responses given in the Circles test (an item of the Torrance Tests of Creative Thinking) were analyzed separately, i.e., each response of each *S*. Two types of responses were differentiated; in one of them the reprinted circle was not crossed, that is, the original stimulus figure contained the response. We called this the "internal" or "inner-space" response. In the other, lines were drawn outside the circle as well. We called this the "external" or "outer-space" response. Those cases where the subject had drawn more than one circle were also classified as "outer-space" ones. In

order to compensate for possible effects of the total number of responses, an "internal response score" was computed as a ratio of the number of internal responses to the total number of circles utilized by the subject.

Results

On the basis of means and standard deviations of the raw scores on the Mf (MMPI) and the Fe (CPI) scales, two pairs of groups were established. In the first, masculine males and females *vs* feminine males and females were grouped together (Mf M = 26.59 SD = 3.99; M = 34.47 SD = 3.92; Fe M = 20.11 SD = 3.52; M = 22.98 SD = 3.86). In the second, males *vs* females were grouped without regard to masculinity and femininity. An analysis of variance was computed upon the inner-space ratios of the above groups. For Group I: MMPI $F_{sex} = 0.0379$, df = 1/198, $F_{M-F} = 8.4277$, df = 1/198, $p < 0.01$; $F_{sex \times M-F} = 8.6824$, df = 1/198, $p < 0.01$. For Group II: MMPI $F_{sex} = 0.8126$, df = 1/190, $F_{M-F} = 5.8560$, df = 1/190, $p < 0.05$, $F_{sex \times M-F} = 7.4428$, df = 1/190, $p < 0.01$. For Group II: CPI $F_{sex} = 0.8096$, df = 1/190, $F_{M-F} = 4.9509$, df = 1/190, $p < 0.05$, $F_{sex \times M-F} = = 7.5470$, df = 1/190, $p < 0.01$. The results show that there is no difference between males and females concerning the number of inner-space responses. At the same time, both feminine females and males gave a significantly greater number of inner-space responses. The interactions were also significant. These findings corroborate our hypothesis that the processing of perceptual units by subjects with cross-gender identification tends to be "extreme". This appears to be especially characteristic of masculine females (Figure 1). Analyzing the Circles test by the above procedure might also prove to be a method appropriate for diagnosing masculinity *vs* femininity.

Method B

Four extreme groups were formed of 366 *S*s on the basis of data concerning Mf scores and inner-space ratios. One criterion was the assumption of an increased masculine or an increased feminine identi-

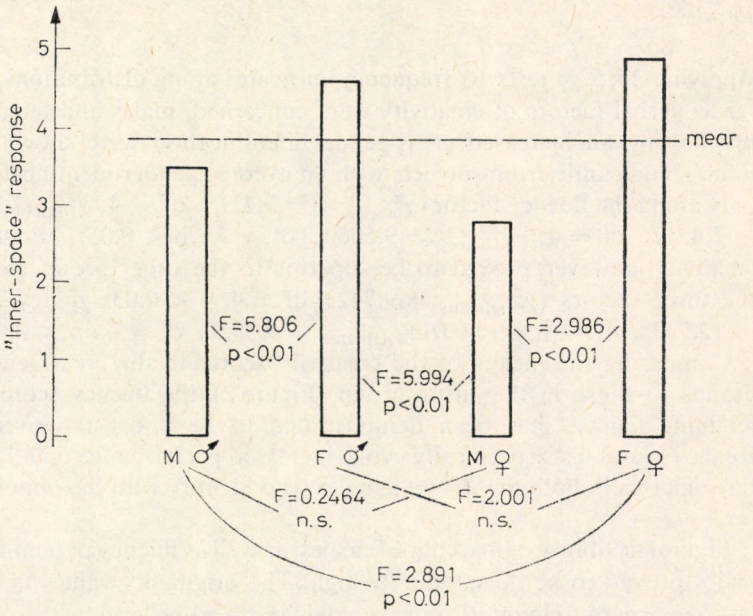

Figure 1. Means and differences in "inner-space" responses according to the M–F

fication in cases with an Mf score one SD above or below the mean. Another criterion for the selection of groups was that the subjects, already considered to be masculine or feminine according to their questionnaire scores, produce a maximum of 20% and a minimum of 80% inner-space responses, respectively. The total number of *S*s satisfying both criteria was 61 (9 masculine males, 23 masculine females, 13 feminine males and 16 feminine females).

The originality, flexibility and fluency scores of the overall distributions of creativity test data were then compared with the performance of the selected groups with increased cross-gender identification. (The creativity test battery used with all *S*s consisted of two verbal items, the Unusual Uses test and the Remote Associations test, see Barkóczi and Klein, 1968; and two figural items, the Circles test and the Picture Completion test, see Torrance, 1966).

Results

Applying 2×5 χ^2 tests to frequency measures along distributions, as far as verbal factors of creativity were concerned, males and females manifesting an increased cross-gender identification were shown to differ significantly from subjects with an average gender identification only along the fluency factor ($\chi^2_{originality} = 7.4218$, $df = 4$; $\chi^2_{flexibility} = = 1.4217$, $df = 4$; $\chi^2_{fluency} = 9.5060$, $df = 4$, $p < 0.05$). Figural creativity, however, proved to be superior to the other group along the three factors ($\chi^2_{originality} = 9.7423$, $df = 4$, $p < 0.05$; $\chi^2_{flexibility} = = 12.7438$, $df = 4$, $p < 0.01$; $\chi^2_{fluency} = 9.5950$, $df = 4$, $p < 0.05$).

Comparing the means of the creativity scores in the cross-gender groups to those in the entire group (Figure 2), the fluency score of feminine females has been demonstrated to be under the overall mean. Figural tests specifically evoke increased performance on all the three factors in both males and females who identify with the opposite sex.

Figural flexibility of masculine females, as well as fluency of feminine males proved to be outstandingly high. The originality values in the last two groups amounted approximately to the same level.

Summary

The higher proportion of internal responses is significantly related to the femininity factor. Contrary to Erikson's assumptions, according to which the use of internal space and that of external space is characteristic of females and males, respectively, an increased ratio of internal responses has been found here in the case of feminine males as well. In our opinion, this fact may be, therefore, interpreted as a constituent of psychosexual roles evolving through the acquisition of social behavioural roles, i.e., through social learning processes.

According to one of our hypotheses, the adoption of the psychosexual role of the opposite sex is a characteristic of creative persons. This hypothesis was corroborated by the creativity scores of highly masculine females and highly feminine males. Members of the latter group showed a higher performance than those of the group consisting of persons with identifications corresponding to their own sex in a

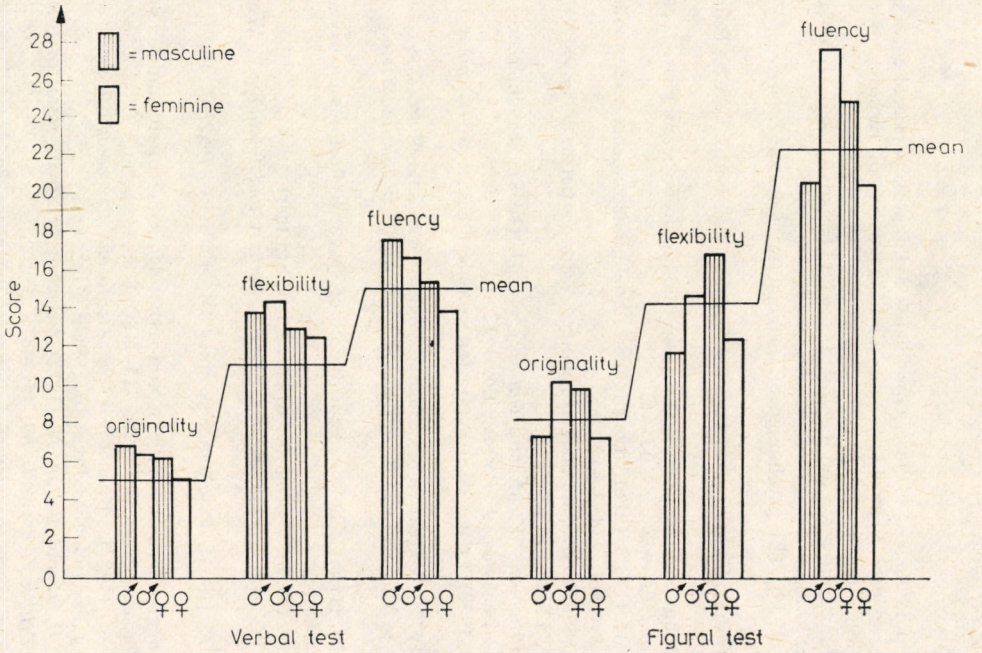

Figure 2. Means of creativity of the extreme masculine and extreme feminine groups compared to the whole sample (n = 396)

number of factors: in all three creativity factors in figural tests, as well as in the fluency factor in verbal tests.

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Gizella B. Kakas

Study of the relationship between creativity and frustration tolerance

The aim of this study was to reveal the relationship between creativity and behaviour in frustrating situations. Researchers, dealing with the relations between creativity and personality traits, suggest that creative people possess such personality characteristics that can become manifest in their behaviour and serve to decrease the strain of frustration. For instance, MacKinnon (1965) refers to autonomy as a creative personality trait which can be related to a need for independent solutions of the frustrating situation. Maddi (1965) states that the creative person must possess the ability to tolerate the restrictions of the environment and to surmount the obstacles of frustration.

A task that demands creativity, that is, one that needs more than a mechanical application of the person's knowledge, is itself a source of frustration. In addition to this observation, Torrance (1965) emphasizes the development of the ability to tolerate frustrating problem-situations as an important factor of the education of creativity. Barron (1968) states, on the basis of his studies, that "healthy" attitudes are positively related to feminine values and psychasthenia, and negatively related to extraversion. These features suggest a decrease of and control over outward directed aggression as a consequence of sublimation and introversion. The author claims that these healthy attitudes are at the same time accompanied by curiosity, a higher level of ego development, independence, vitality, originality, creativity, achievement motivation and visual abilities (p. 289). In these investigations of Barron's the students of the Rhode Island School of Design were involved. Concerning a group of administrators, Barron characterizes people of high originality and low intelligence with the following features: sensible, aggressive, demanding, dependent and dominant, strong, impatient, initiative, outspoken, sarcastic, strong and susceptible to influence (p. 222). The following features were found to describe per-

sons of high intelligence and low originality: mild, optimistic, satisfied, peaceful, unselfish. The author assumes, on the basis of the study, that it is intelligence that is responsible for impulse control. There were no data in the study concerning highly original and highly intelligent people. Elaborating upon Barron's conclusions drawn from his Rhode Island study, we believe that creativity by itself may be responsible for impulse control, at least under environmental conditions where the nature of the job makes creativity a necessary condition. In fact, in such cases, persons of high originality feel more sure of themselves than ones of low originality, which makes the former more tolerant of frustrations.

Thus, it must be taken into consideration when studying the relationship between creativity and frustration tolerance that, although people are motivated to decrease tension in problem situations, behaviour takes place in a given environment, under given conditions, adapted to them. That is, circumstantial aspects of an activity must be taken into account, as well as the person's intellectual power, which also affects behaviour. Therefore, it is desirable to compare people of the same level of intelligence and interest, under the same conditions.

The following relationships were expected between the frequency values of the indices of a frustration test and creativity in the case of highly intelligent people: the creative person's need for autonomous solutions of the situation should appear in the frequency of the i index concerning impulse control, a diminished frequency of the aggression indices, especially E and E', was expected. It was assumed that a creative individual shows greater response-variability than a less creative one.

Methods

Creativity was measured by using Guilford's Signs test, Torrance's Circles test, the Number Combination test and Barkóczi's Sentence Completion test (Torrance, 1968; Barkóczi and Klein, 1968). Data concerning a Hungarian standard of the creativity tests were available (Zétényi, 1973). Frustration reactions were investigated by the use of Rosenzweig's Picture Frustration test (PFT) (Rosenzweig *et al.*, 1946; Rosenzweig *et al.*, 1947). The subjects' level of intelligence was

assessed by the use of Raven's Standard Progressive Matrices. IQ was computed by matching the raw test scores to the IQ scores. Care was taken to ensure the homogeneity of the groups. In order to test and ensure homogeneity, subjects were investigated with respect to their interests, attention potential and occupational satisfaction. The fluency, flexibility and originality values assessed by separate creativity tests were summed and compared with the frequency of different reactions to frustration measured by the PFT.

Two methods were applied to process the data: (1) Correlations were computed between the fluency, flexibility and originality values and the frequency of frustration parameters. (2) Subjects of high and low originality were selected and their PFT profiles were compared.

Subjects. Young engineers working at a research institute and just starting their career were asked to take part in the study. Our groups consisted of 37 subjects, (12 women and 25 men). Their average age was 25.7, ± 2.3 years.

Results and conclusions

Mean values for each group are as follows:
IQ = 123 ± 9. A relatively high and homogeneous intelligence level was one of the most important preconditions of the study, since frustration reactions were to be matched to creativity without the equalizing or even distorting influence of intelligence. It should be noted that the threshold above which IQ does not effect creativity is about 120 (Roe, 1965). Creativity values derived from the different tests were as follows:

fluency:	49.9 ± 13.8
flexibility:	27.9 ± 7.6
originality:	19.6 ± 6.7

Frequencies of frustration reactions in our group were generally between the normal 40–60 T standard values. The exceptions were the M' parameter with an average greater than 60, and the I parameter with a T value less than 40. A low T standard suggests that the designated reaction is less important than average, while a high standard value

Table I. Correlations between percentage frequency values of PFT reactions and compound creativity parameters

Creativity parameter / PFT sign of reaction	Σflu r	Σflex r	Σorig r
E'	−0.46**	−0.31	−0.44**
I'	0.41*	0.45**	0.31
M'	—	−0.41*	−0.37*
e	0.29	0.33	0.31
O−D	−0.34*	−0.36*	−0.45**

* $p < 0.05$
** $p < 0.01$

suggests a more definitive role in the determination of behaviour, but only major deviations are interpreted as abnormal.

Significant correlations between creativity and frequency values of frustration parameters are shown in Table I.

E' designates reaction when the subject aggressively emphasizes the obstacle. A frustrated person is irritable and reacts to the obstacle with helpless rage because he is unable to resolve the frustrating situation. It is not necessary to explain the fact that this parameter is negatively correlated with creativity.

I' designates responses suggesting that the subject does not regard the obstacle as frustrating and might even find the situation to his advantage. This is a frequent kind of reaction of introverts indicating embarrassment and uneasiness, and it is self-punishing in character (Szakács, 1979). The person is sensitive to frustration. Since it suggests that the person is hardly able to overcome frustration, its positive correlation with creativity is less unambiguous than the E' parameter's negative one. The greater frequency of I' reactions might suggest that there are more introverts among creative people than among less creative ones. There is some evidence supporting this hypothesis in the studies of Cross *et al.* (1967).

M' is the symbol of the impunitive response. The person interprets the obstacle by pretending that it is unimportant thus indicating a paradox behav iour and repression. MacKinnon (1965) points out that

repression counteracts creativity irrespective of the person's intellect. The negative correlation of M' with creativity is as necessary as that of the E' reaction.

The e reaction indicates the need to have frustration solved by someone else. It can show self-fulfilment, as well as a request for help. Request for help is an indication of dependence that would contradict the creative person's independence mentioned earlier. However, it is clear from the exploration that only 18% of the people of high creativity preferred working alone to team work, while those of low and moderate creativity preferred working alone in 38% of the cases. This fact seemingly contradicts independence, too. Team work nowadays is a condition for the solution of most experimental tasks, therefore, the fact that persons of high creativity seem to prefer it may come from the motivation to attain quickly the correct solution. Thus, the positive correlation between creativity and the e index found in our study might be an indication of cooperativeness including dominance, as well as request for help.

The O-D index is a comprehensive indicator of obstacle-dominated responses. The negative correlation obtained shows that the creative person does not stick to emphasizing the obstacle, but can go beyond it. Its negative correlation with creativity is self-evident.

In the next part of the investigations the subjects showing high and low originality were selected and frequencies of their PFT parameters were compared. It was mentioned earlier that an increase was hypothesized in the variability of behaviour in frustrating situations paralleling increases in creativity. The following method was used to assess the variability of behaviour: responses of the subject were assigned to one of 11 categories distinguished by 11 different signs. The individual may choose some of these kinds of behaviour more often than others, and some of them perhaps never. If all of the 11 different response types are present in the person's response repertory, then his/her response variability is maximal. Both response variability and reaction frequency were related to the total number of responses to make the values comparable. Thus, maximum response variability is expressed by the formula:

$$\frac{\text{(possibilities)}}{\text{(total number of responses)}} \quad \frac{11}{24} \times 100$$

Table II. Mean values of PFT reactions as percents of the total number of responses

Sign of reaction	High (27.6±4.8; n = 11)		Average (18.8±2.8; n = 16)		Low (12.2±1.6; n = 10)		High *vs* Low significant difference
	originality						
	Mean	T	Mean	T	Mean	T	
E'	3.3± 2.9	41.4	7.5± 4.4	48.6	8.1± 5.6	50.0	$p < 0.05$
I'	2.9± 3.5	44.5	3.2± 2.6	45.0	1.3± 2.1	40.5	
M'	12.4± 5.1	66.7	13.5± 6.3	69.6	19.3± 7.4	83.5	$p < 0.05$
E	28.8±19.4	48.0	32.7±14.8	50.3	28.0± 9.6	47.4	
I	5.8± 4.8	38.9	4.6± 4.1	36.8	6.0± 4.0	39.4	
N	8.5± 5.0	41.6	7.3± 5.3	40.0	4.9± 5.3	36.7	
e	11.1± 5.7	60.2	9.7± 6.4	57.8	7.7± 7.0	56.4	
i	8.2± 5.3	50.3	7.0± 4.8	48.0	8.1± 4.7	50.0	
m	9.8± 4.2	57.0	6.2± 5.7	49.7	7.7± 5.2	52.8	
E	5.6± 4.5	48.1	6.2± 3.0	49.8	5.9± 4.9	49.3	
I	3.6± 4.3	44.0	2.2± 2.7	43.0	3.0± 2.8	42.5	
O−D	18.6± 6.0	49.0	24.1± 8.0	56.4	28.7± 7.7	61.0	$p < 0.01$
E−D	52.3± 8.0	43.0	53.0±14.9	44.0	47.8±11.5	39.0	
N−P	29.1± 8.5	58.0	22.0±10.1	52.6	23.5±11.7	52.0	
ΣE	48.9±11.7	51.0	56.1±12.0	56.5	49.7± 9.6	52.0	
ΣI	20.0± 6.4	44.5	17.0± 7.1	41.0	18.3± 3.9	42.0	
ΣM	30.7± 9.8	55.5	26.9±10.6	49.9	31.9± 9.9	55.0	
GCR	51.5±10.4		51.9±10.6		52.2±11.7		
Resp. variability	85.8±11.6		81.5±11.9		77.3± 5.2		$p < 0.05$

The mean values of PFT reactions and response variability expressed as a percentage of the total number of responses for each subject are given in Table II, concerning subjects of high, average and low level of originality. Beside the percentages of the PFT indices, the T standard corresponding to the mean values are also presented.

When we examine the data shown in Table II, we can see that those parameters of low and high originality subjects differ significantly which were shown above to be directly related to creativity (E', M', O-D parameters).

Response variability is significantly greater for subjects of higher originality than for those of lower originality. We can summarize our results as follows: High creativity subjects show greater response variability in frustrating situations than lower originality subjects. We

have failed to find the expected higher frequency of the i index indicating independent solution. Concerning the control of impulses, which was expected to be manifested in a lower frequency of aggression, it was found that the least efficient reaction, namely, the aggressive emphasis of frustration (E'), was indeed rarely given by creative subjects.

It is characteristic of low creativity persons that they are less able to solve a problem in a frustrating situation. They react either with helpless rage (E') or with suppression (M'). Lower level of creativity seems to be related to this general problem of decreasing tension which leads to the fixation of behaviour as a result of an emotional block (O – D). Fixation of behaviour is always maladaptive and inconsistent with the image of the creative person as revealed by research.

Our results suggest that the control of impulses is affected by the level of creativity, as well as by intelligence, presumably, as a function of expectations.

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Attila Oláh

Creativity and personality variables

It soon became clear during the 30 years of research of creativity that intellectual potential is a necessary but not sufficient condition of original creation and of our contribution to the creative transformation of our environment.

Psychometric research into the personality background of creativity had its beginning with the works of Roe (1952), Cattell and Drevdahl (1955) and Barron (1955). Most of the studies carried out so far, that focus on the personality aspect of creativity, use two sets of criteria: (a) real life productions, inventions, scientific and artistic accomplishments; (b) performance on the so-called cognitive creativity tests. Hence the most frequent research strategies involve the analysis of outstanding scientists', artists' and inventors' personality on the one hand (either from a biographical point of view or by applying personality tests), and the examination of persons giving the best performance on creativity tests on the other. Up to now, some 90 personality factors that have something to do with creativity have been discovered by diverse methods.

The two most well-known and thorough of these are the MacKinnon IPAR project and a study carried out by Cattell and his co-workers. In these studies the most reliable methods for the investigation of personality (MMPI, CPI, 16PF, TAT, etc.) were administered to creative people working in diverse fields (architects, writers, mathematicians, chemists, psychologists, and artists). Summarizing their findings, it can be concluded that creative people show a characteristic personality profile on personality inventories regardless of their profession. Drevdahl and Cattell (1958) and Chambers (1964, 1966) compared the test-profiles of people eminent in artistic and scientific creativity, using various measures of profile similarity and found them to belong to the same "profile family". There are, of course, essential differences between each group of creative people with respect to special abilities and

personality traits, but *originality*, *independence*, *openness*, *emotional sensibility*, and a *high degree of ego strength* were present in each group. According to Cattell and Butcher (1968), any person who can be described by the above characteristics, is a representative of the creative personality type.

On the basis of inventory data obtained from artists and scientists, both MacKinnon and Wallace (1969) and Cattell and Butcher (1968) suggested an equation, derived by applying stepwise regression, to identify the creative personality profile. In 16PF (Cattell and Butcher, 1968) creative potential is most reliably predicted by the following regression equation: Creative potential = 0.25, B+0.46 C+0.32 E−0.46 I+0.33 N+0.45 Q_1+0.29 Q_2−0.35, where B = general intelligence, C = ego strength, E = dominance, I = emotional sensibility, N = cleverness, Q_1 = radicalism, Q_2 = self-esteem.

MacKinnon verified on architects, using data on validity as well, that in the CPI (Gough, 1957) creativity is best predicted by the following regression equation: Creative potential = 0.547 Sp−1.015 Ac+0.990 Fe, where Sp = Social presence, Ac = Achievement via conformance, Fe = Femininity.

It was also found in several studies (e.g., Werner and Bachtold, 1969; Payne *et al.*, 1973) that young people active in artistic or scientific fields and considered creative by their teachers, colleagues or peers, show a personality profile similar to that of scientists or artists on various personality inventories. These findings suggest that test-profiles of eminent creative people's personalities can be taken into consideration when attempting to construct indices "predicting creativity" from personality inventories.

As to the other research strategy—when the criterion is the performance on open-ended tests—it is still an open question whether those who take an original approach in the test-situation are indeed creative in other fields or on later occasions, too. Despite the fact that the validity indices of creativity tests are not very high, correlation co-efficients indicating empirical and concurrent validity are found to be somewhere between 0.2 and 0.5, both in international and Hungarian research (cf. Guilford, 1959; Pléh, 1970; Csépe, 1976; Oláh, 1979); it is interesting to note that the personality profiles of groups with good performance on tests requiring divergent thinking and originality are to some extent similar to those of scientists and artists.

Findings of researches carried out at different places and times are summarized in Table I. In six of these studies the criterion of creativity was actual achievement, while in the other six it was the score on tests measuring divergent thinking. The people found creative, according to the different criteria, in all twelve studies were administered the California Psychological Inventory.

Correlation and *t*-values shown in Table I suggest that creativity, evaluated according to two different criteria, is related to several identical personality variables (dominance, status-potential, self-control, independence, flexibility).

In spite of the fact that several so-called correlational investigations have been developed to study the relationships between personality factors and creative potential, a detailed comparative analysis of the personality profiles of people, selected according to two different criteria of creativity, has not been done by the personality centred creativity research.

It is assumed that such an analysis might provide new data for the description of the creative personality and might contribute to the clarification of some of the validity problems concerning creativity tests.

The purpose of our study was to answer the following questions:
(1) What are the characteristic personality traits of people regarded as creative on the basis of their productions (inventions, scientific publications)?
(2) What scores do these people achieve on creativity tests as compared to the performance of their colleagues?
(3) What are the characteristic personality traits of subjects of various ages achieving outstanding scores on creativity tests?
(4) What are the characteristic differences or similarities at various ages in the personality profiles of people selected according to the two traditional criteria of creativity?

Methods

Subjects. 431 men took part in the investigations. Our sample can be divided into two sub-samples, according to profession and age-group characteristics: Engineer groups (A) and secondary school students' groups (B).

Table I. Differences based on t-values between CPI scales of groups found creative correlations between a variety

CPI scales	Do	Cs	Sy	Sp	Sa	Wb	Re
Garwood (1964) 18 successful *vs* 18 average male researchers	4.5		3.7	5.3	3.1		
Helson (1967) 34 creative *vs* 29 non-creative male mathematicians							
Helson and Crutchfield (1970) 18 creative *vs* 29 non-creative female mathematicians							
Barron (1955) 15 original *vs* 15 non-original men according to originality test	4.7				2.7		
Csépe (1976) 20 inventor *vs* 25 practicing engineers	2.3	2.0					
Oláh (1979) 22 original women *vs* 24 non-original women according to originality test	2.7	2.9		3.2			
Gough (1969) 100 men on creativity test	0.45	0.29	0.27	0.26	0.35	−0.19	
Holland and Astin (1962) 681 art scholarship winners	0.22	0.19	0.18	0.14	0.17		
McDermid (1965) 38 innovator engineers							
Barron (1955) 50 men on originality test	0.29						
MacKinnon (1964) 124 male architects				0.18	0.19	−0.20	−0.20
Oláh (1979) 50 men on originality test	0.49						
Oláh (1979) 163 women on originality test		0.23	0.26				

and non-creative according to their achievements and cognitive test scores, and of creativity criteria and the CPI scales

So	Sc	To	Gi	Cm	Ac	Ai	Ie	Py	Fx	Fe
−3.2	−3.8		−4.4							
	−3.9								2.0	
					−3.5				4.3	
	1.9									
2.1	7.5		2.8			2.0			6.6	3.9
							2.8	2.7	2.6	
	−0.28					0.19	0.22			
	−0.09			−0.08						
						0.27				
	−0.39									
	−0.31	−0.21	−0.23	−0.31	−0.24				0.24	0.24
					0.38	0.35	0.35		0.38	0.33
						0.24	0.21	0.21	0.23	

Engineer groups

I. *Creative engineers* (n = 47) (19 architects, 11 chemical engineers, 17 mechanical engineers)
The criterion for their creativity was professional achievement: they were selected for this group on the basis of their patented inventions, their achievements in competitions and the number of publications. Mean age was 37.2.
II. *Engineers with excellent performance on creativity tests* (n = 48)
Upper 20% of an engineer group of 240 on the basis of test scores. Mean age was 34.6.
III. *Engineers with poor performance on creativity tests* (n = 48)
Lower 20% on the basis of test scores of the engineers' group mentioned under II. Mean age was 39.2.
IV. *Control group* (n = 50)
Architects, chemical engineers and mechanical engineers without any significant inventions or publications made up the group. Mean age was 35.8.
V. *Creative architects* (n = 31)
Architects who had won 1st, 2nd or 3rd prize in competitions. Mean age was 38.8
VI. *Architects with excellent performance on creativity tests* (n = 22)
Upper 25% of an architects' group of 88 on the basis of test scores. Mean age was 31.2.
VII. *Control group* (n = 29)
Architects without placing on a competition. Mean age was 37.0.

Secondary school students' groups

1. *Creative students* (n = 34)
Students who had taken one of the first ten positions in competitions. Competitors are required to prepare an original competition essay in some scientific field. Mean age was 17.8.
2. *Students with excellent performance on creativity tests* (n = 36)
Upper 20% of a students' group of 180 on the basis of test scores. Mean age was 17.6.

3. *Students with poor performance on creativity tests* (n = 36)
Lower 20% on the basis of test scores of the students' group mentioned under 2. Mean age was 17.6.
4. *Control group* (n = 50)
Two average secondary school classes. Mean age was 17.7.

Methods for measuring creativity

Circles (Torrance, 1968), Unusual Uses (Guilford and Hoepfner, 1965), Remote Association (Barkóczi, 1973), and Picture Completion (Torrance, 1968) tests were used. Only originality was taken into consideration in the evaluation of the test scores. The originality score was computed according to Barkóczi and Klein (1968).

The creativity tests were administered to every group.

Methods for investigating personality traits

A Hungarian adaptation (Oláh, 1979) of the California Psychological Inventory (Gough, 1957) and the Rorschach test were used. The California Psychological Inventory was filled out by all of the subjects except the members of Groups V, VI and VII, while the Rorschach test was administered only to these three groups. The tests were administered at different places during the years of 1976–1980; the creativity tests and the California Psychological Inventory were administered to small groups, while the Rorschach test was done in private.

Results

Validity of creativity tests

The mean and standard deviations of originality scores on the creativity tests for each group are shown in Table II.

Originality scores of Group I (Creative engineers) and those of Group IV (Control engineers) were compared by a *t*-test: t = 2.033

Table II. Mean values and standard deviations of originality indices of creativity tests for each group

Groups	I	II	III	IV	V*
Number of subjects	n = 47	n = 48	n = 48	n = 50	n = 31
$\bar{X}$	18.72	22.05	10.49	16.27	
SD	6.02	2.42	1.95	5.78	

Groups	VI	VII*	1	2	3	4
Number of subjects	n = 22	n = 29	n = 34	n = 36	n = 36	n = 50
$\bar{X}$	20.72		16.75	19.78	8.77	14.32
SD	2.91		5.81	2.18	2.18	5.21

* A different kind of creativity test was used for Groups V and VII, therefore, these data were omitted from processing.

($p < 0.05$). The same procedure was carried out on the data of Group 1 (Creative students) and those of Group 4 (Contro students): $t = 2.002$ ($p < 0.05$).

These results suggest that both creative engineers and creative students achieve a significantly higher performance on creativity tests than their colleagues with average abilitites, and, at the same time, the mean score does not differ significantly from that of the groups producing the best test scores. The mean scores of Groups I and II, and Groups 1 and 2 are not significantly different in either of the cases: $d = 0.513$ and $d = 0.478$.

These results suggest that the empirical validity of originality, which can be considered as the most reliable factor of creativity tests, is sufficient. These data are consistent with those reported by Csépe (1976) and with those found in our own previous studies (Oláh, 1980).

One of the reasons for choosing the California Psychological Inventory (CPI) (Gough, 1957) to study personality variables was that this is the only multidimensional inventory which is standardized for the Hungarian population (Oláh, 1979), the other was that this method investigates personality factors that are, according to several theories (e.g., Maslow, 1959; Rogers, 1959; and Barron, 1964), closely related to creativity.

Each of the 18 scales of the Inventory identify one personality factor. These are as follows (the original abbreviations are in parenthesis): Dominance (Do), Capicity for status (Cs), Sociability (Sy), Social presence (Sp), Self-acceptance (Sa), Well-being (Wb), Responsibility (Re), Degree of socialization (So), Self-control (Sc), Tolerance (To), Good impression (Gi), Communality (Cm), Achievement with conformity (Ac), Achievement with independence (Ai), Intellectual efficiency (Ie), Psychological sense (Py), Flexibility (Fx), Femininity (Fe).

During standardization the dimensional structure of the CPI was also tested. According to a factor analysis, 4 groups can be formed from the scales:

I. Emotionality–stability (Sc, Gi, Wb, To, Ac, Fe, So, Ie)
II. Extraversion–introversion (Sy, Do, Sa, Cs, Sp)
III. Conventionality (Fe, Cm)
IV. Independence–originality (Fx, Ai, Py)

We have named the scale-groups ourselves after having analyzed the content of the dimensions.

Table III shows group-means for each scale, Tables IV and V contain the test-profiles of the groups, while Table VI shows group differences for each scale in a pairwise comparison. When interpreting the test profiles and the *t*-tests, an attempt was made to answer the questions formulated in the introduction, that is, what personality traits can be found to be related to the two criteria of creativity (i.e., achievement and test score).

Engineer groups

First, analyzing the test profiles of the four engineer groups (Table III), it was found that – in spite of the similarity of their profession and

*Table III. CPI means for each group**

Groups	I	II	III	IV	1	2	3	4
Number of subjects	n = 47	n = 48	n = 48	n = 50	n = 34	n = 36	n = 36	n = 50
Do	27.2	32.8	29.1	29.2	26.1	31.4	25.4	25.2
Cs	21.4	22.6	15.1	16.4	17.4	18.3	17.3	16.8
Sy	20.2	25.2	24.2	21.6	20.2	25.2	21.6	23.2
Sp	32.2	37.4	30.4	32.6	32.2	37.6	30.4	31.6
Sa	26.3	21.6	16.7	19.6	24.2	20.8	19.3	20.3
Wb	35.4	40.3	37.3	35.6	33.2	34.2	35.3	34.3
Re	29.4	31.8	31.2	30.2	30.0	31.2	31.4	30.6
So	31.8	37.7	36.3	35.0	31.4	35.2	33.4	33.2
Sc	34.2	35.4	30.2	32.2	31.8	32.0	33.2	34.2
To	26.4	22.2	18.1	21.2	23.3	23.2	21.2	21.8
Gi	21.3	28.1	32.4	22.4	21.4	26.4	25.3	23.2
Cm	20.2	24.1	25.2	23.0	19.2	22.2	21.0	22.2
Ac	28.4	30.2	26.4	22.6	28.4	30.0	27.8	29.2
Ai	23.8	20.2	15.1	17.6	22.4	19.8	18.1	18.1
Ie	41.2	43.2	37.2	39.0	43.4	42.6	37.2	38.2
Py	17.2	14.2	10.2	11.4	16.3	14.4	11.1	12.2
Fx	13.6	9.1	4.8	6.2	12.4	9.8	6.2	7.1
Fe	24.6	20.1	18.3	17.2	23.2	22.2	22.1	20.2

* Members of Groups V, VI and VII did not do the CPI.

age – there were essential differences in the CPI-profiles of the groups. The most consistent personality profile was produced by the engineer group excelling in creativity tests (Group II), while the most complex and dynamic one was characteristic of the creative engineer group (Group I). The complexity of their personality is indicated by their differentiated abilities, the richness of their motivations and the sophistication of their emotions. It is characteristic of this group that some of their traits are a good deal more developed than is usual (To, Ai, Py, Fx, Fe), while others are less "refined" (Sy, Sp). Group II's personality traits, assessed by the CPI, are in harmony, but they are less differentiated. Groups I and II were found to be differentiated. Groups I and II were found to be different in 13 of the 18 personality traits investigated. Engineers excelling in creativity tests (Group II) are socially more effective (Sp), more dominant (Do), more sociable (Sy), more contented

(Wb) and, at the same time, they are more adaptive (So), are better at "self-presentation", at making a good impression on others (Gi), than their productive colleagues (Group I). Engineers who have proved their creativity by their work are more aware of their own abilities, therefore, they are more self-assured (Sa), independent (Ai), tolerant (To), flexible (Fx), sensible and open (Py, Fe), than their colleagues who give good performance on creativity tests.

In order to outline a differentiated personality profile and to evaluate the predictive validity of creativity tests, it seems useful to consider personality factors that differentiate the most characteristically between groups of engineers of average ability (Control group IV), the ones good in creativity tests (Group II) and creative engineers (Group I). According to the *t*-tests presented in Table IV, there are five scales in the CPI (self-acceptance, psychological sense, flexibility, femininity, independence) that distinguish significantly between these three groups. These results suggest that the degree of elaboration of the traits, assessed by the above discussed scales, is closely connected to the extent and level of creative abilities – if we accept that original production in real life (Taylor's level of innovation; Taylor, 1959) represents a higher level of creativity than test scores.

The Sa, Py, Fx, Fe, Ai values are the lowest in the CPI test profile of engineers who perform poorly on creativity tests (Group III). This fact also supports the assumption that production of higher level creative achievements and consistent application of "creative strategies" involve a high level of elaboration of the above personality traits.

Student groups

Our aim in examining the student groups was twofold: on the one hand, we wanted to test to what extent can the relationships found between the two criteria of creativity and personality traits within a particular profession be generalized; on the other hand, we wanted to test to what extent this relationship is affected by age. The CPI profile patterns of the four student groups are shown in Table V. The overall profiles do not show the characteristic between-group differences that was found for the engineer groups. Supposedly, this is due to a lack of

Table IV

CPI-ELTE 1978

MALE PROFILE

Name: _____ Age: _____ Date: _____

Other information: _____

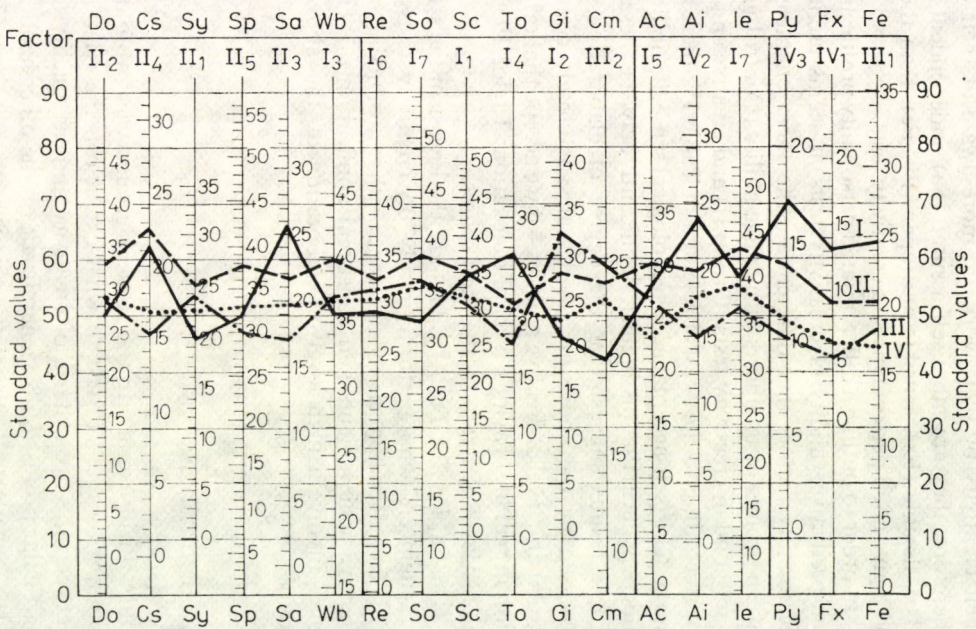


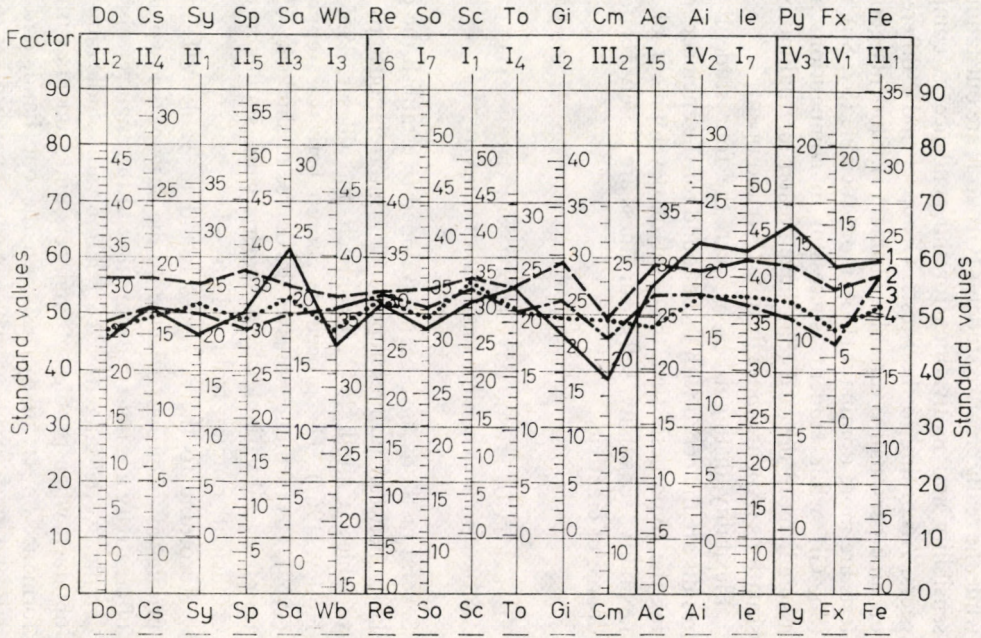
Table V

CPI-ELTE 1978

MALE PROFILE

Name: _____ Age: _____ Date: _____

Other information: _____



differentiation of abilities and personality traits at this age. Similarly to the engineer sample, however, students giving eminent performance on creativity tests (Group 2) are outstanding concerning social skills, while the really creative students (Group 1) are outstanding concerning sensibility and motivations for independence as compared to their peers. According to the *t*-tests, Groups 1 and 2 differed significantly on nine personality variables (Table VI). Students good at creativity tests are more dominant (Do), more sociable (Sy, Sp), more adaptive (So, Gi), while students successful in competitions are more self-assured, more devoted (Sa), have greater internal motivations in task situations (Ai), are more flexible (Fx) and open.

Flexibility distinguishes between the four student groups. These results are in accord with those found for the engineer groups, supporting the hypothesis that the level of development of independence, flexibility, sensibility, self-assuredness are closely related to a higher degree of creativity.

Similarity of personality profiles of groups selected according to the two criteria of creativity

Several methods have been developed to establish the degree of similarity between profiles representing interrelationships of personality variables (Cattell, 1949; Cronbach and Gleser, 1953; Sjöberg and Holley, 1967). The procedure chosen here was reported by Cohen (1969). His formula expresses the degree of similarity of profiles made up of several variables by a numeric value similar to the correlation coefficient, ranging from -1 to $+1$.

According to the r_c values found in Table VII, the overall CPI profiles of the groups selected on the basis of the two different criteria of creativity are not similar neither in the engineer nor in the student sample. At the same time, correlation values indicating similarity were obtained when profiles of engineers and students with excellent performance on creativity tests, on the one hand, and engineers and students with excellent achievements, on the other, were compared. These data are consistent with previous results indicating that people with outstanding achievements show similar profiles in personality inventories, no matter what their field of work is (Drevdahl and

Table VI. Comparison of CPI means of each group by t-*test*

Groups	I and II	I and IV	II and III	II and IV	1 and 2	1 and 4	2 and 3	2 and 4
Do	−3.62***	n.s.	2.33*	2.41*	3.12**	n.s.	3.45**	2.86**
Cs	n.s.	6.12***	8.21***	7.12***	n.s.	n.s.	n.s.	n.s.
Sy	−4.71***	n.s.	n.s.	3.21**	−4.51***	−2.29*	2.72**	n.s.
Sp	−2.82**	n.s.	3.48***	2.47*	−2.89**	n.s.	3.68***	3.25***
Sa	6.41***	7.48***	5.71***	n.s.	5.22***	5.18***	n.s.	n.s.
Wb	−4.2***	n.s.	2.42*	3.93***	n.s.	n.s.	n.s.	n.s.
Re	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
So	−3.02**	−2.31*	n.s.	n.s.	−2.53*	n.s.	n.s.	n.s.
Sc	n.s.	n.s.	4.11***	2.61*	n.s.	n.s.	n.s.	n.s.
To	2.52*	3.44**	2.36*	n.s.	n.s.	n.s.	n.s.	n.s.
Gi	−4.34***	n.s.	2.52*	3.28**	−2.41*	n.s.	n.s.	2.32*
Cm	−3.62***	−2.41*	n.s.	n.s.	−2.12*	−2.52*	n.s.	n.s.
Ac	n.s.	n.s.	2.38*	2.42*	n.s.	n.s.	n.s.	n.s.
Ai	2.78**	5.23***	3.87***	2.09*	2.13*	3.52***	n.s.	n.s.
Ie	n.s.	n.s.	4.21***	2.89**	n.s.	3.41**	3.52***	3.12**
Py	3.22**	5.59***	4.17***	2.84**	n.s.	4.51***	3.12**	2.27*
Fx	4.23***	6.65***	3.92***	2.52*	2.21*	5.21***	2.82**	2.45*
Fe	3.62***	7.14***	n.s.	3.02**	n.s.	3.4**	n.s.	n.s.

*** $p < 0.001$
** $p < 0.01$
* $p < 0.05$

Table VII. Similarity of the groups selected according to the two different creativity criteria with respect to personality profiles as shown by Cohen's r_c index

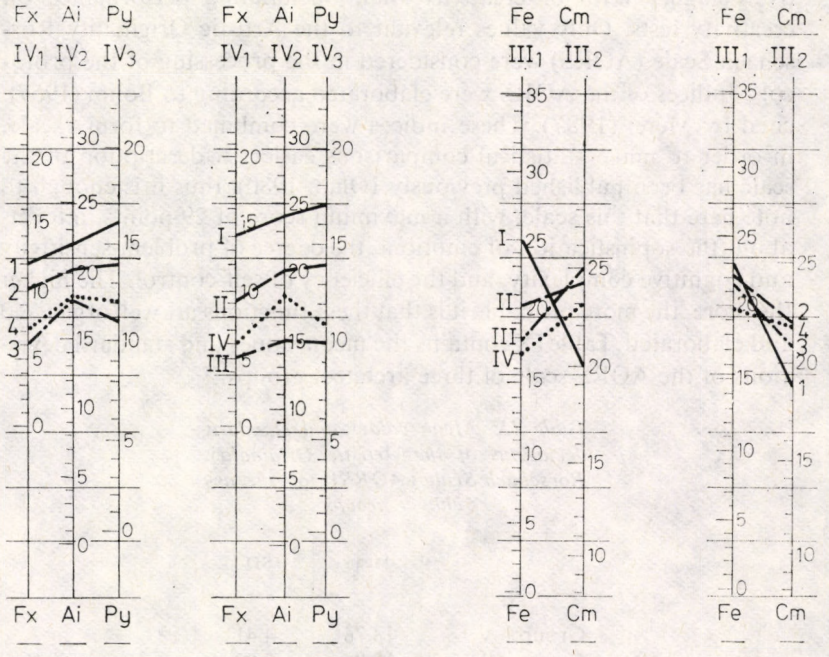
Groups	I and II	1 and 2	I and 1	II and 2
r_c CPI entire profile	0.11	0.21	0.41	0.38
r_c CPI conventionality factor	−0.18	−0.12	0.58	0.02
r_c CPI independence–originality factor	0.28	0.31	0.61	0.47

Cattell, 1958; Cattell and Butcher, 1968), and, at the same time, they suggest that the two criteria of creativity tend to cluster people into different profile-families.

Looking for the reasons of profile differences among the groups selected according to the two kinds of criteria, it seemed possible that we may also obtain useful information by making the comparisons according to the CPI's factor structure. As noted earlier, the CPI scales are organized into four factors. The 3rd (Conventionality) and the 4th (Independence–Originality) factors were selected as possibly the most important ones for the analysis of the creative personality. Table VIII shows the profiles representing the interrelations of the personality variables which belong to the 3rd and 4th factors.

The pattern of profiles (Table VIII) and the negative r_c values indicate clearly that the groups selected according to the two criteria of creativity have opposite trends with respect to the conventionality factor. This is revealed by the fact that preference of the "beaten path" and conventional solutions are more characteristic of persons with eminent performance on creativity tests than of the really creative ones. The fundamental difference between the groups, selected according to the two kinds of criteria, seems to be that while both groups are characterized by openness, problem-sensitivity, the ability to use divergent strategies (cf. the r_c values indicating the similarity of the 4th factor-profiles of the groups), the realization of these potentials is more restricted by a more rigid following of conventions and well-proven

Table VIII



forms in the case of samples selected on the basis of high performance on creativity tests. Similarity with respect to factors 3 and 4 in the CPI of the profiles of groups selected on the basis of their real life achievements is even more obvious ($r_c = 0.58$ and 0.61), which is in accordance with the earlier results.

Architect groups

Our aim in the examination of architect groups was to test whether we can establish by a projective method (and not only by self-report data) that complexity, degree of differentiation of the personality, or some factors of personality are closely related to the qualitative level of creative work. In considering this hypothesis, Taylor's (1959) division concerning levels of creativity was accepted, namely, that the so-called

innovative level (original productions in real life) represents a qualitatively higher level of creativity than outstanding performance on creativity tests. Only values relevant to the Artistic Originality Rorschach Scale (AORS) were considered in the processing of the protocols. Indices of the AORS were elaborated according to Bohm (1957), cited by Mérei (1987). These indices were combined to form a scale, in order to make statistical comparisons easier. A description of the scale has been published previously (Oláh, 1980), thus it is enough to note here that this scale, with a maximum score of 29 points, informs about the sophistication of emotions, the degree of problem-sensitivity and cognitive complexity, and the efficiency of self-control. The higher the score, the more probable it is that these functions are well organized and elaborated. Table IX contains the mean values and standard deviations of the AORS scale of three architect groups.

Table IX. Mean values and standard deviations of the Artistic Originality Rorschach Scale (AORS) for the architect groups

	Mean	SD
Group V	18.76	4.41
Group VI	15.86	3.93
Group VII	12.75	5.21

The highest value was given by the group successful in competitions, while the lowest AORS mean was obtained from the control group. To compare the groups' mean values, a one-way analysis of variance and *t*-tests were performed.

According to the ANOVA ($F(2.79) = 4.93$, $p < 0.05$) the groups differed significantly and this result was corroborated by *t*-tests computed for pairwise comparisons of the groups (between groups V and VII: $t = 4.831$, $p < 0.001$; between groups V and VI: $t = 2.465$, $p < 0.05$; between groups VI and VII: $t = 2.341$, $p < 0.05$). These significant results support our hypothesis that a more sophisticated structure of emotions, a higher level of cognitive complexity and a higher level of organization of self-control functions are related to a higher level of creative productivity.

Discussion

It was one of the aims of our study, carried out with various profession and age-groups and by the use of several methods, to clarify the validity problems of the so-called cognitive creativity tests and to perform a comparative analysis of personality profiles of subjects selected according to the two classical criteria of creativity. It was found that engineers and students who had proved their creativity by their achievements, did significantly better on creativity tests. Although these data support the validity of creativity tests, it is argued that creativity test scores are inadequate to serve as sole criteria for predicting creativity. These tests provide reliable information primarily about the subjects' ability to apply divergent strategies when (1) they are explicitly asked to (this is what the instruction is for); and (2) when they are provided with tasks or problem situations suitable for exercising those abilities. The special production surface of creativity tests makes them unsuitable to provide information of whether or not a person spontaneously seeks, recognizes, prefers tasks or problems requiring divergent strategies. An additional question that cannot be assessed by creativity tests, is whether the person is able to consistently maintain such a strategy even though his environment does not demand it nor stand in his way, that is, has he got the necessary personality characteristics. Since the assessment of creativity by tests is such a model situation where the subject is given a "ready-made" problem and is oriented towards the required strategy, it may have the consequence that those subjects tend to do best on the tests who – besides being able to apply divergent strategies – have a greater than average tendency to comply with expectations. In our sample, the tendency of the good-in-test engineers and students to be conventional and to make favourable impression on others is more obvious when their personality inventory data are compared with those of their colleagues who have proved their creativity by actual achievements. The fundamental difference between people selected according to the two criteria of creativity in both professional and age-groups was that the engineers, students and architects who are creative in their own fields of interest, too, by relying more on their creative virtues (high self-esteem), can realize their creativity in a more determinate manner, more consistently, by paying little attention to habits and traditions, and without too

much need for external reinforcement. Our findings suggest that personality functions that provide flexibility, independence, reliability, emotional stability are more elaborated and organized in the case of engineers and students whose work proves their creativity, than in the case of good-in-test subjects. There seems to be a generally valid relationship between the level of development of flexibility, sensibility, independence and self-assuredness as personality factors, and a high level of creativity.

On the basis of the relationships found between the two different criteria of creativity and the personality factors, it is proposed that if we want to use creativity test scores (showing whether the person is able to find original solutions and use divergent strategies) to predict creative potential, we have to find out whether it is accompanied by the high level organization of those personality traits that make it possible to actualize and maintain these divergent strategies.

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Ilona Barkóczi and Csaba Pléh

Psychological examination of the Kodály method of musical education*

The purpose and general design of the longitudinal investigation

Kodály's system of musical education is well known around the world. During the last three decades some of its basic elements have become part of the elementary school curriculum everywhere in Hungary. Besides this regular curriculum, comprising two hours a week of musical education, there are special so-called music classes in which music is studied 5 hours a week. The basic purpose of our research was the comparison of these two systems regarding their possible developmental effects in elementary school children.

The psychological implications of Kodály's educational concept can be summarized, after Kokas (1972), as follows. The basic musical material in this system consists of folk songs supplemented with a selection of pieces from professional music. The pentaton system, characteristic of the more archaic layer of Hungarian folk songs, is extremely suitable for the development of an inner imagination of tones, of inner hearing, even in the case of children with average or little musical ability. An essential part of the system is the recognition that it is active singing which leads most directly to an experience of music, to its full understanding and to the development of inner hearing. For this last purpose, as well as for the development of musical literacy, the method of relative solmization proved to be most adequate.

The practice series, composed by Kodály (1944–1945) for educational purposes, constitute a complete system which aims to develop inner hearing and exact intonation by providing multiple combinatorial possibilities for hearing and intonation. There is an emphasis on the development of musical memory through practice with songs,

* Based on a study with the same title, *Kodály zenei nevelési módszerének pszichológiai hatásvizsgálata*, Kecskemét, 1978.

rhymes, playful movements and hand gestures, and also through the separation of melody and rhythm at the beginning. It is noteworthy that the systems of notation are also varied; children learn to use different symbolic forms. (Alphabetic abbreviations for the solmizatized notes on the one hand, and regular notation on the other.) This varied and flexible practice provides the basis for the development of an integrated relationship between visual symbols, the actually heard musical elements and those heard internally. All of these exercises with fixed musical structures organized into a logical system, take place in playful situations, and the experience of happy common singing ensures emotional and aesthetic enrichment. Hungarian folklore that is used by the Kodály method, is very rich in cheerful rhymes and games accompanied by singing, which mediate varied role-relationships for the children and provide them with the surplus of shared experience.

It has been noted many times by educators that children attending music classes tend to show higher achievement in other scholastic subjects, too, despite the fact that there is no selection or only a minimal musical selection for enrolling in these classes. The first investigations in this area were carried out by Kokas (1972). She had shown that there is a positive transfer effect of Kodály's method of musical education on several other areas of the elementary school curriculum (such as grammar, spelling, reading, mathematics and physical education). These results were the starting point of our investigation, insofar as they called for a more psychologically oriented, better controlled and longitudinal study of the factors underlying these transfer effects.

In the late sixties, on the basis of the manifold transfer effects known by then, we had hypothesized that these effects might be mediated by a more general effect of the Kodály method on intellectual development. Our main purpose in this study was to investigate this possibility. Two approaches for the study of intellectual development were chosen: (a) the study of intelligence measured by traditional intelligence tests and (b) the study of creativity measured by adapted versions of creativity tests developed by Guilford (1959, 1967) and Torrance (1962, 1964). These two approaches concentrate on what is commonly referred to as *convergent* and *divergent thinking* (Guilford, 1959). Convergent thinking is associated with a type of problem-solving strategy in which gradual reduction of the alternatives, critical

information selection, abstraction and reasoning are the dominant features as the subject approaches the single correct solution of the problem. Traditional tests of intelligence involve mainly this kind of problem solving. In divergent thinking, on the other hand, there is no tendency to reduce the problem to one single solution; the subject ventures in diverging directions, mobilizing often very distant and surprising relationships. Since a lot of data show that intelligence is relatively stable in school age (for a review see Bloom, 1964), we hypothesized that *Kodály's method of musical education has a positive effect mainly on the development of divergent thinking (creativity), while leaving convergent thinking (IQ) relatively unaffected.*

We also wanted to study the temporal course of the possible effects of musical education on the development of intellectual functions. For this purpose, we carried out a longitudinal study in which we tested the performance of 6–10-year-old children, in different intellectual tasks in four consecutive years. Some of these children participated in special Kodály training courses, while others did not. Some further questions of the investigation involved the relationships between different intellectual abilities on the one hand, and between these abilities and some environmental factors under the influence of musical training on the other. It is a well-known fact in creativity research that there is zero or very low correlation between intelligence scores and scores on tests of creative thinking. (For a classical demonstration see Getzels and Jackson, 1962, and for a review of the literature see Barkóczi *et al.*, 1975.) Hungarian data showed a correlation of 0.30–0.40 between creativity and intelligence in 10–12-year-old children, and while there was a positive correlation between the IQ and the socio-economic status of the parents of the 10–11-year-olds (0.43–0.46 in two subsamples), no significant correlations were obtained between different measures of creativity and the same environmental variable. In the longitudinal study we wanted to see specifically whether musical training has any influence on these relationships. For example, does it have a levelling or a contrastive influence on the relationship between intelligence and creativity? Finally, in the last two years of the investigation, some non-intellectual measurements, mainly personality tests, were also administered to the children in order to see whether musical education has any effect on the formation of the emotional and motivational aspects of personality.

Outline of the methods used

The investigations were carried out in May of each year between 1969 and 1972, in Kecskemét (Hungary). With a few exceptions (see later), children were tested individually by trained psychology students, following standardized procedures which emphasized the importance of personal contact and a relaxed atmosphere in the testing sessions. Testing took place at the Kodály Zoltán Elementary School in Kecskemét.

1. Tests of intelligence

In the first year the Hungarian adaptation of the Binet scale (by Éltes and Baranyai) was administered. At the end of the second year a partial testing of intelligence was carried out by using the following 5 subtests from the German version (HAWIK) of the Wechsler Intelligence Scale for Children: Situations, Superordinate Concepts, Digit Span, Signs, and Picture Arrangement. In the fourth year the entire HAWIK test was administered.

2. Measurement of creativity

At the time of the investigation no psychometric methods for the measurement of creativity in children were available in Hungary, although research on adult populations had already been started at the General Psychology Department of the Eötvös Loránd University. Therefore, a battery of tests applicable to young children had to be developed in the course of the investigation. This procedure had a trivial shortcoming from the psychometric point of view, namely, that the only basis for comparison was our own sample.

In designing the tests of divergent thinking we relied mainly on the works of Guilford and Hoepfner (1965), and Torrance (1962, 1964). The following tests were used:

Circles (Torrance, 1962). The child has a sheet of legal size paper with printed circles on it. His task is to draw as many things as he can by using the circles as part of each drawing. Time: 10 minutes.

Make Things Better (Torrance, 1962). The child is presented with a funny-looking, stuffed toy dog, and his task is to invent changes in the toy that would make it more interesting to play with. Time: 8 minutes.

Unusual Uses (Guilford, 1959). The child is told the name of an everyday object (newspaper, key, etc.), and his task is to invent uncommon uses for this object. Time: 3 minutes for each item. Each year two of the items were replaced in this test to avoid stereotyping.

Consequences (Guilford and Hoepfner, 1965). The child is asked to describe what would happen if certain fantastic conditions became true, e.g., if people understood what animals were saying, or if people became invisible. Time: 4 minutes for each item. Here, again, two different items were used each year.

Signs (Three Lines) (Guilford and Hoepfner, 1965). The child is given three small rods of equal length (like the ones used in teaching mathematics) and he has to construct with them whatever shape he wants. From the third year on, instructions have emphasized the construction of signs (symbols), like in the adult version. Time: 5 minutes.

Fantasy Story (Flying monkey) (Torrance, 1962). The child has to tell a fantastic story about a little monkey that can fly. Time: 3 minutes.

Creative Activity Questionnaire (Torrance, 1962). In the fourth year, in a classroom situation, the children have to fill in a questionnaire consisting of 81 questions about their independent creative leisure-time activities. (More details about the questionnaire will be given together with the results.)

In all creativity tests instructions emphasized originality and independence of thought. The usual creativity tests (all but the last two in the above list) were evaluated by using three different indices, each corresponding to one of the basic factors of creativity suggested by Guilford (1967). *Fluency* simply indicates the number of adequate

(acceptable) answers in a given test. *Flexibility* was measured by grouping the answers to each item into content categories (following the practice of Torrance, 1962). The number of categories used by a subject in a given test was taken as a measure of his flexibility in that test.

In order to characterize *originality*, first the frequency of each response and of each response category to every item was counted. Then each response was given an originality score varying between 0 and 3. Responses given by more than 20% of the children were worth 0 point, while those between 5 and 19.99% were worth 1 point, those between 2 and 4.99% 2 points, and those under 2% 3 points. The overall originality score then for a subject in a given test consisted of the sum of these scores associated with each of the responses in that test.

3. Non-intellectual tests

In the third year Piéron's standard figural cancelling method for studying sustained attention and a Hungarian version of the Chil-

Table I. Tests used in different years of the investigation

Tests \ Year	1969 (1st)	1970 (2nd)	1971 (3rd)	1972 (4th)
Intelligence	Binet–Éltes–Baranyai	HAWIK-5 subtests	–	HAWIK (Wechsler)
Circles	+	+	+	+
Make Things Better	+	+	–	+
Unusual Uses	+	+	+	+
Consequences	+	+	–	+
Signs	+	+	+	+
Fantasy Story	–	–	+	–
Creative Activities Questionnaire	–	–	+	–
Piéron Cancelling Test	–	–	+	–
Manifest Anxiety Scale	–	–	+	–
Rorschach Test	–	–	–	+

dren's Manifest Anxiety Scale (Forrai, 1968) were used in order to test for any possible changes in attention, performance, or anxiety due to the influence of musical education. Since none of these methods showed significant differences, they will not be discussed here.

In the fourth year the Rorschach test was administered to the children to test for personality differences between the groups. Its results will be discussed later.

Table I shows the methods used each year.

Subjects

Since the basic purpose of the investigation was to analyze the effects of Kodály's method of musical education, it was very important to control all other factors as much as possible. With this aim in mind, in the first year we had selected three classes in a Kecskemét school for the purpose of an educational longitudinal experiment. The first was one of the first-grade classes of that year in the Kodály Zoltán Elementary School of Music. There is a minimal musical selection in this school. Parental self-selection, however, as it will be seen below, might be a more important factor in determining the social composition of this class. Complete lack of selection characterized the other two classes of a school in a low-standard neighbourhood. After enrollment, one of these was randomly selected to become a special music class, with the other class as its control. This meant that a music teacher from the Kodály School of Music came to teach them 5 times a week, while children in the control group had their music classes twice a week taught by their regular classroom teacher. The shortcomings of this arrangement are evident and they must be kept in mind when interpreting the results. The possible effects of having two teachers instead of one, along with the possible general effects of the visiting teacher's "educational philosophy" and teaching style may very well have biased the results in one direction or the other.

After having analyzed the data at the end of the first year, it became apparent that pupils in the Kodály school are superior to the other two classes in terms of intelligence and also the socio-economic status of their parents. In order to control this latter factor, a more systematic analysis of the socio-economic status (SES) of the children

was undertaken, in which the following factors were taken into consideration:

(a) parents' education	2–12 points
(b) parents' occupation	2–12 points
(c) per capita income	1– 7 points

The scores obtained for each child along these factors formed the SES scale ranging from 5 to 31. The means for the 3 classes were as follows: Kodály school = 29.9; Low SES, Music = 13.3; Low SES, No Music = 10.9. A Mann-Whitney *U*-test showed that while the Kodály class differed significantly ($p < 0.01$) from both of the other two classes, the two low SES classes did not differ significantly from each other.

Thus, it seems that the simple musical selection by the Kodály school and the selection due to parental aspirations result in strong social selection. Recognition of this asymmetry in our design led us to form a fourth group to serve as the control group for the Kodály class. Children for this fourth group were chosen by using the method of paired matching from two parallel classes of a school of relatively high social standard. Thus, these children were "social twins" of the children in the Kodály school group with respect to the five factors of the SES. The final design, therefore, comprised 2×2 factors: the special musical education factor became supplemented by the SES factor. Table II shows some of the main characteristics of the four groups.

As the data in Table II show, there is a most disturbing decline in the number of subjects in the (most critical) ML group. In the third year, for administrative reasons (use of day-care facilities), children were redistributed among the classes in this school. We have only used data coming from those children who have participated in the special musical education at least from the second year on. Hence the decline in the number of subjects.

Some principles of our data analysis

An attempt was made to test all relevant paired comparisons. The two pairs of groups of matched SES, which differed only with respect to the presence or absence of special musical training (MH–NMH

Table II. Characteristics and composition of the experimental groups

Group	Code	Starting *n*	Boys	Girls	*n* at the end
1: High SES, special Music	MH	29	7	22	28
2: High SES, No Music	NMH	27	11	16	29
3: Low SES, special Music	ML	30	13	17	21
4: Low SES, No Music	NML	28	15	13	26
Total		114	46	68	104

and ML–NML), were always compared. Concerning the effects of SES, the MH–ML and NMH–NML comparisons acquired special importance where the compared groups were educationally equivalent. Different combinations of the four classes were also compared, in order to observe the effect of musical training independently of SES, for example.

Non-parametric methods were used to test for the significance of the differences found, except in the case of IQ measurements where the normality condition was assured. In this latter case, *t*-tests were applied, while for the other indices Mann-Whitney *U*-tests and Chi^2-tests were used. In order to simplify presentation, in addition to the basic descriptive characteristics (means and SDs), most of the time only the significance levels will be given for each of the comparisons rather than the statistics themselves.

Effects on intellectual development

Intelligence

Complete intelligence scale was obtained only in the first and the fourth years, but two different tests were used. A further problem is that while the Binet-type test used in the first year had been standard-

Table III. Average IQs in the first and fourth years

	MH	NMH	ML	NML
1969	111.3	—	97.2	97.8
1972	120.9	131.9	113.8	113.4
VQ (1972)	125.4	130.6	117.2	119.1
PQ (1972)	111.6	121.2	107.4	104.0

ized for Hungarian children (Baranyai), in the case of the Wechsler test used in the fourth year only the German standard was available. While the overall mean of our sample measured by the Binet-Éltes-Baranyai test was 102.5, the one obtained with the HAWIK was 123. This means that the German standard is not really applicable to the Hungarian population and the two tests cannot be compared directly. The IQ data presented in Table III have to be considered with this in mind.

In the first year the MH group shows a highly significant superiority over the two Low SES groups ($p < 0.001$). This advantage is present in the fourth year, too ($p < 0.05$). Musical training had no effect on IQ in the two Low SES groups. In the fourth year the NMH group is superior to all the other three groups at a 0.001 level.

Considering the differences in intelligence scores between the two measurements, although overall difference is due to the difference of the tests, there is some indication that Low SES children may develop faster in certain respects. Differences in intelligence test scores between the first and fourth years were: MH = 9.6; ML = 16.6; NML = = 14.6 points.

The NMH group showed a superiority especially in practical intelligence (PQ). While there were no significant differences between the two High SES groups in either VQ (verbal intelligence) or PQ, they were both better than the Low SES groups in verbal intelligence. In practical intelligence, however, only the NMH group was superior to them ($p < 0.05$).

If we consider the partial intelligence test administered in the second year and the corresponding subtests of the HAWIK in the fourth year, we obtain the picture indicated in Table IV. A detailed analysis

Table IV. Results and percent increase in the repeated subtests of the HAWIK

	Year	MH	%	NMH	%	ML	%	NML	%
Life Situations	1st	10.9	135	12.1	154	8.8	171	8.4	178
	4th	14.6		18.6		15.4		15.0	
Superordinations	1st	11.9	150	11.6	182	8.8	183	9.4	179
	4th	17.8		21.2		16.2		16.7	
Digit Span	1st	8.7	120	9.0	114	8.4	118	7.8	126
	4th	10.4		10.3		9.8		9.8	
Picture Arrangement	1st	15.8	173	18.4	190	12.0	168	15.0	158
	4th	27.3		35.0		20.1		23.7	

of the results in the second year shows that SES had a very definite influence on performance in the Superordination task (MH *vs* Low SES, $p < 0.01$; NMH *vs* Low SES, $p < 0.05$). Social status proved to be an important factor in determining performance in the Life Situations subtest, too, which involves practical orientation in the social world. In this task both High SES groups were superior to the two Low SES groups ($p < 0.05$ and 0.01). Furthermore the NMH group performed better than the MH group ($p < 0.05$). This superiority of the deliberately selected group in tasks involving social cognition was clearest in the Picture Arrangement subtask where the NMH group showed an advantage over all the other groups ($p < 0.01$, 0.01, and 0.05, respectively), but these groups did not differ among themselves.

The Low SES children, as indicated by the percent columns, showed a relatively faster development rate in the Life Situations task, implicating a compensation for their initial lower level of social skills. In the other tasks where their development rate was fast (Superordinates and Picture Arrangement), the High SES groups also showed a roughly equal rate of development.

In the second year the NMH group showed better performance in the Digit Span task than either of the two Low SES groups (M, $p < 0.05$; NM, $p < 0.01$). The Low SES group participating in special musical training also obtained higher scores than its social control group ($p < 0.05$). This difference, however, disappeared with age.

In summary, *in accordance with our expectations, Kodály's system of musical education does not improve the general level of intelligence* (convergent thinking), neither in High nor in Low SES children. Social status, on the other hand, has the expected strong influence on IQ, and Low SES represents a specific disadvantage for young children in tasks involving social cognition.

Creativity

The *Circles* test was administered in the same way in all four years. In the first year, however, many children did not understand one important aspect of the task, namely, that the circles have to become parts of the drawing. These children used the circles as "frames" for their drawings. This tendency was related to the intelligence level of the children: those children who made 2 or more drawings, correctly following the instruction, tended to be more intelligent in all the three classes (MH, $p < 0.10$; ML, $p < 0.10$; NML, $p < 0.05$). Thus, superiority in fluency of the MH group over the two others in the first year ($p < 0.05$) might be explained partly by the difference in intelligence between the groups. The striking development in fluency found in the case of the two Low SES groups, as indicated in Figure 1, is largely due to a better understanding of the task.

Overall development during the four years is shown in Table V (with relative yearly increase given in percent) and in Figures 1 and 2. The High SES group participating in musical education kept its leading position throughout. The extreme low position of the Low SES No Music group was also stable throughout, showing almost total stagnation concerning originality in the last year. In the Low SES groups, children participating in special musical training were always superior to their controls and, as shown in the Figures, this difference increased with age. The High SES No Music group showed no superior performance on any index in any year when compared to the

Table V. Group means in the Circles test

	Year	MH		NMH		ML		NML	
		M	%	M	%	M	%	M	%
Fluency	1969	6.1[a]		—		3.2		2.7	
	1970	10.0	164	7.8		8.2	259	5.9[i]	218
	1971	17.9[a]	179	12.3	158	11.7	141	8.1[i]	137
	1972	18.6	104	15.9	129	14.2	121	10.0[i]	123
* Flexibility	1971	8.6		7.9		6.3		5.1[i]	
	1972	9.1	106	9.0	114	8.3	131	6.9[i]	135
*Originality	1970	9.5[bd]		7.1		7.3		7.2	
	1971	14.7[a]	155	12.2[f]	172	10.0	137	7.8	108
	1972	19.0[cd]	129	15.9	130	12.0	120	8.2	105

In this and the following Tables % means increase in percent compared to the previous testing.

The code letters mean the following significant differences:

	a	b	c	d
MH better than	all others	NMH	ML	NML
	e	f		
NMH better than	ML	NML		
	g	h		
ML better than	NMH	NML		
	i			
all others better than	NML			

j

High SES (MH+NMH) *better than low SES* (ML+NML)

* We were unable to include Flexibility in the first two years and Originality in the first year due to the low number of adequate responses.

Low SES Music group, although a tendency in this direction can be observed in the originality scores of the last year. Thus, *musical training seems to be advantageous in the development of creativity as measured by the Circles test for both SES levels.*

The *Make Things Better* test was applied three times, using the same instructions. Results are summarized in Table VI and in Figures

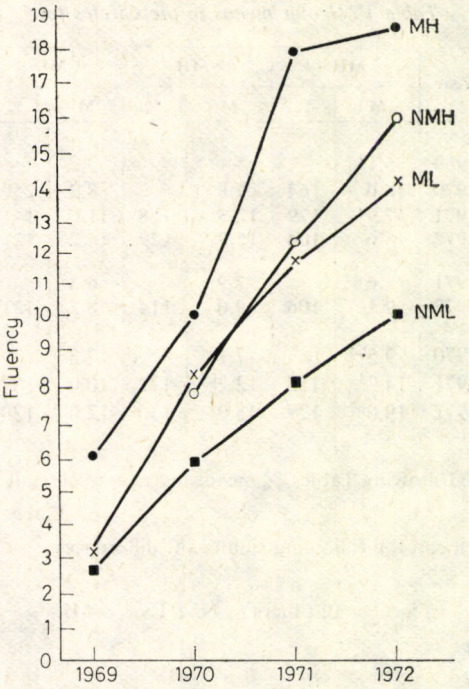

Figure 1. Development of fluency in the Circles test

Table VI. Group means and percentile changes in the Make Things Better test

Groups / Factors	Year	MH		NMH		ML		NML	
		M	%	M	%	M	%	M	%
Fluency	1969	6.6[a]				5.6		3.2	
	1970	12.0[a]	182	7.6[f]		9.9[h]	177	4.9	153
	1972	14.2[a]	118	10.8	142	9.8	99	8.6	175
Flexibility	1969	4.4[d]				2.7		2.0	
	1970	5.3[a]	120	4.1[f]		3.9[h]	144	2.2[c]	110
	1972	8.4[a]	158	6.3	153	6.0	154	4.7	214
Originality	1969	3.4[d]				2.1		1.4	
	1970	12.7[a]	375	8.4[f]		9.2[h]	438	3.3[i]	236
	1972	18.3[cd]	144	15.8[ef]	188	12.2	133	10.9	330

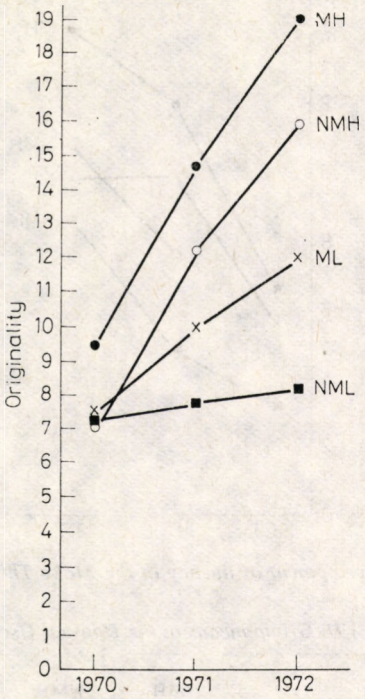

Figure 2. Development of originality in the Circles test

3, 4, and 5. Similarly to the previous task, here, too, the MH groups showed the highest performance throughout with regard to all three indicators.

The NML group showed the poorest performance. The ML group was superior to its Low SES control all the time, except for the last year. The high social status group receiving no special musical education showed a superior performance over the ML group only in the originality score of the last year. Thus, *the positive effect of musical education on creativity* can be observed in this test, too.

The *Unusual Uses* test was administered every year, but with different items each year. Therefore, the longitudinal changes are confounded with the effects of the items themselves. Because of this, interpretation of the data presented in Table VII, and in Figures 6,

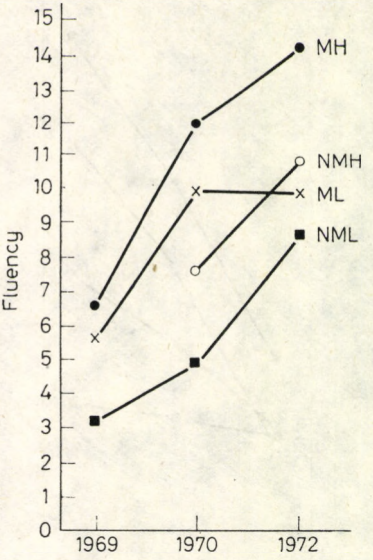

Figure 3. Development of fluency in the Make Things Better test

Table VII. Group means in the Unusual Uses test

	Year	MH	NMH	ML	NML
Fluency	1969	4.5	—	6.2[h]	3.7
	1970	7.4	7.5	7.3	5.0[i]
	1971	7.7[cd]	7.0[ef]	5.1	4.8
	1972	8.3	6.4	9.1[gh]	6.6
Flexibility	1969	4.2	—	3.0	3.1
	1970	4.1	5.0	4.5	3.8[i]
	1971	4.4[c]	4.1	3.3	2.3[i]
	1972	4.5[b]	3.9	5.4[gh]	4.8
* Originality	1970	11.9[h]	9.9	9.7	5.1[i]
	1971	8.8[d]	8.1	6.8	5.0
	1972	13.7	9.6	11.5	8.8

* Since in the first year originality was scored differently than in the following years, the data thus obtained are not meaningfully comparable and are therefore omitted.

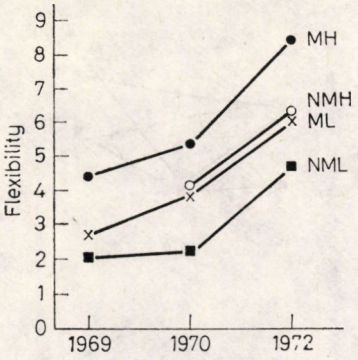

Figure 4. Development of flexibility in the Make Things Better test

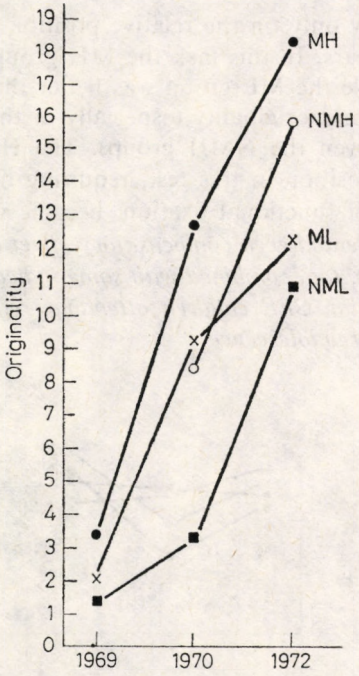

Figure 5. Development of originality in the Make Things Better test

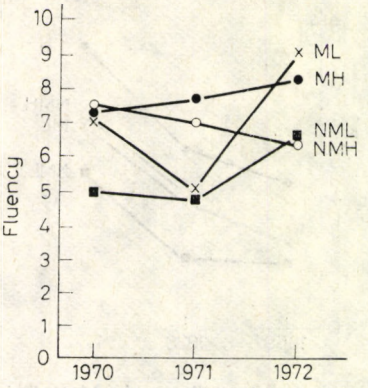

Figure 6. Development of fluency in the Unusual Uses test

7, and 8 must rely only on the relative position of the three groups in the different years. In this task the MH group was better mainly in originality, while the ML group was better than its social control group in fluency and originality (especially in the last year, when it was better than even the NMH group). The High SES No Music group's relative position in this test, requiring flexibility of thought and overcoming of functional fixation, became worse with time.

Thus, the positive and even compensatory effect of musical education appears in this test, too, combined with some indication of a weakening of flexibility in High SES children attending regular classes at the time of reaching preadolescence.

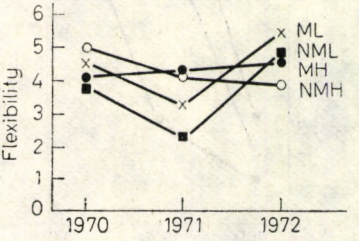

Figure 7. Development of flexibility in the Unusual Uses test

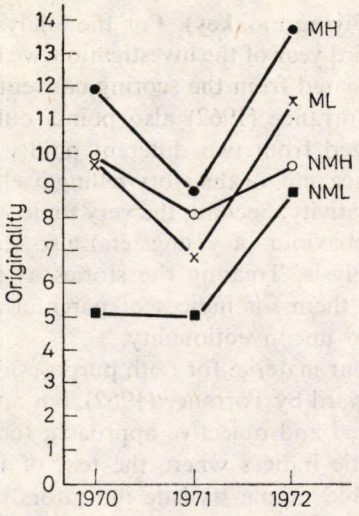

Figure 8. Development of originality in the Unusual Uses test

In the *Three Lines* (Signs) test there were hardly any significant differences between the groups. Only the NML group differed from the others in the fluency scores of the first year. The actual drop in the second year was due to a change in instruction: from then on, children had to construct signs from the three rods. It seems that at this age the emphasis on signs tends to direct the child's fantasy to the finite system of letters and numbers, thus encouraging conformity of thought rather than originality.

The *Consequences* test did not differentiate too well between the four groups either. The striking improvement in performance in the last year was mainly due to the easier items introduced that year. (Items were changed in this test every year, like in the Unusual Uses test.) In addition to this practically simultaneous improvement in all four groups, the only significant difference indicated a superiority of the MH group and the low performance of the other extreme group, NML, in fluency and flexibility in the first two years. We had a feeling that this test was too difficult to bring out any subtle influence at these ages.

Fantasy Story (Flying monkey). For the analysis of this task, applied only in the third year of the investigation, we have devised special methods which deviated from the scoring conventions used with creativity tests. As Torrance (1962) also points out, protocols in this task can be analyzed from two different points of view. First, the originality, coherence, etc. of the story-telling itself can be interpreted as a measure of creativity. Second, the very topic given to the children (unconventional behaviour of youngsters) also lends itself to a projective type of analysis. Treating the stories as projective material, one could look in them for indices of parental and other environmental reactions to unconventionality.

We tried to use our material for both purposes. We relied partly on the indices put forward by Torrance (1962), but an attempt was made to use a more varied and objective approach, too. This is especially true of the linguistic indices where the text of the story itself was analyzed for possible simple stylistic indicators of creativity.

The following indicators were obtained from the stories:

(1) *Story length.* Total number of words in the story;

(2) *Type/token ratio.* This very widely used indicator of style was obtained by dividing the number of different content words (types) by the total number of content words. Articles, pronouns and connectives (function words) were excluded from this analysis;

(3) *Number of word types;*

(4) *Adequacy of the story.* All stories ignoring the actual task (e.g., a general story about monkeys, etc.) were considered as inadequate;

(5) *Number of characters* in the story;

(6) *Emotional tone of the conclusions:* positive, negative or neutral;

(7) *Emotions of the little monkey.* Only their presence or absence was coded;

(8) *Mockery, amazement, astonishment of other characters directed at the little monkey;*

(9) *Motives of flying* categorized by content;

(10) *Elaboration.* A 1-to-11 scaling was used, mainly following the instructions of Torrance (1962), summing the presence of different elements (number of characters, presence of motive, ending, etc.);

(11) *Organization.* A 1-to-5 subjective scaling was used by the scorers following Yamamoto (cited by Torrance, 1962) to judge the coherence of the story.

Table VIII. Group means for quantitative characteristics of the Flying monkey stories

	MH	%	NMH	%	ML	%	NML	%
Story length	76.6[j]		80.4[j]		56.3		37.0	
Type-token ratio	0.72		0.67		0.70		0.76	
Types	32.9[j]		31.4[j]		26.4		23.7	
Adequate stories	22[j]	85	22[j]	82	12	57	14	61
Inadequate or no story	4	15	5	18	9	43	9	39
Number of characters	3.4[d]		3.1		2.9		2.3	

d = MH better than NML
j = High SES better than Low SES

The basic *quantitative characteristics* of the stories are shown in Table VIII. The two High SES groups were superior to the two Low SES groups with respect to both story length ($p < 0.001$) and the number of types ($p < 0.05$), but at the same time, the Low SES group receiving special musical training showed a tendency to assume an intermediate position in these respects. The TTR did not show any difference between the groups. This is simply due to the fact that this ratio naturally decreases with the length of the text (for a classical review see Miller, 1951), and the stories of the High SES subjects were much longer than those of the Low SES subjects.

Higher SES children also tend to tell more adequate stories than lower SES children. Thus, socio-economic status is a very important factor contributing to the linguistic level of the stories. When looking at the number of characters, the picture obtained is more similar to the results of the creativity tests: the MH group is significantly better than the NML group, while the ML and NMH groups positioned between them are similar to each other.

In the comparisons to follow only the adequate stories were considered. The different *emotional indicators* are summarized in Table IX.

It can be seen that the proportion of negative outcomes decreases from the most favoured condition group (MH) to the least favoured one (NML). Though this tendency does not reach significance ($0.05 < < p < 0.10$), it may be interpreted to suggest that the achievement oriented educational strategies of the families, as well as the achievement oriented musical education tend to enhance fantasy elements related to ambition and failure.

This is coloured by the fact that the proportion of stories containing mockery or ridicule of the unconventional monkey was much higher in the higher SES groups than it was in the lower ones ($p < 0.001$). This may mean that the socialization practices of higher status families tend to make children sensitive to social pressures against incongruent behaviour quite early in their development. Higher SES children also tend to attribute more emotions to the monkey itself. This, on the one hand, might be related to the motivational characteristics of their stories (as will be seen below) and, on the other hand, to the fact that in their stories more emotionally important reactions were directed at the monkey

A content analysis was carried out concerning the *motivation given for the monkey's flying and the conflicts mentioned* in the story. Table X summarizes the distribution of the categories in the different groups.

Table IX. Some emotional characteristics of the Flying monkey stories

	MH		NMH		ML		NML	
	n	%	n	%	n	%	n	%
Outcome:								
Bad	12	54	9	41	5	42	4	29
Good	8	36	11	50	6	50	8	57
Neutral	2	9	2	9	1	8	2	14
Emotions of the monkey:								
Expressed	13[1]	59	17[1]	74	4	33	7	50
None	9	41	5	26	8	67	7	50
		High SES				Low SES		
Mockery, etc. of the monkey:		n	%			n	%	
Expressed		18[1]	41			1	4	
None		26	59			25	96	

In this respect, the most interesting characteristic was the fact that the monkey's flying is less frequently motivated in the High SES group not receiving special musical education than it is in the other groups ($p < 0.05$). At the same time, this group emphasized the adventures resulting from flying much more frequently than did the other groups ($p < 0.01$). One possible interpretation of this difference may be that the values of higher status families lead to a supression of non-comformist fantasies, and musical education counteracts this effect.

Finally, the two subjective scales, as summarized in Table XI, show a pattern similar to those obtained by traditional creativity tests. The NML group received the poorest ratings ($p < 0.001$ and 0.01), and while the most privileged group showed the highest scores, Low SES children participating in Kodály's musical training were on the same level as High SES children with no musical training.

In Table XII we attempted to summarize the results of the fantasy story, partly according to the possible factors of creativity underlying

Table X. Distribution of motivational factors in the stories

	MH	NMH	ML	NML	All
1. Flying is motivated					
(a) imitation of birds, etc.	3	3	2	3	11
(b) flying itself is fun, a source of joy, pride, superiority feelings	4	1	1	2	8
(c) flying for practical purposes (escape)	2	1	2	3	8
(d) a way of wrongdoing	4	1	2	0	7
Total motivated	13	6	7	8	34
2. Flying is non-motivated					
(a) emphasis on adventures due to flying	3	13	4	4	24
(b) main conflict around the acceptance of deviance	4	1	0	0	5
(c) flying is peripheral, no conflicts	2	2	1	2	7
Total non-motivated	9	16	5	6	36

Table XI. Means of the elaboration and organization of the stories

	MH	NMH	ML	NML
Elaboration 1–11 scale	7.6	6.2	5.8	3.1[i]
Organization 1–5 scale	3.7	3.0	3.0	1.3[i]

i = all others better than NML

Table XII. Summary of the results of the fantasy story

Indices	Differences	Interpretation
Story length	High SES > Low SES***	fluency
	ML > NML'	
Number of word types	High SES > Low SES*	fluency/flexibility
Number of characters	MH > NML*	
Elaboration	all better than NML***	elaboration
Organization	all better than NML**	
Adequacy	High SES > Low SES*	adaptation to the task
Mockery, etc.	High SES > Low SES***	adaptation to social norm
Emotions of the monkey	High SES > Low SES*	influence of socio-economic background
Motivation of flying	all others more than NMH*	
Emphasis on adventures	NMH more than others**	

'$0.10 > p > 0.05$ * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

them. This summary suggests that those indicators in the story which are related to creativity factors, namely, to flexibility, fluency and elaboration, follow the main trends found in traditional creativity tests. That is to say, MH shows the highest and NML the lowest performance, with the NMH and ML groups taking up an intermediate position. However, in a verbal task requiring construction of connected discourse (as opposed to creativity tests), social factors seem to have a more determining influence than they do in creativity tests. But the indicators conditionally connected with elaboration, which is also a much emphasized factor of creativity (Guilford, 1967), show a stronger influence of musical education than of SES.

Factors of social status play a most important role in the measures connected with adequacy. A similar interpretation can be given for the data on the emotional and motivational aspects of the stories.

Evidently, a more careful consideration of the possible differences in socialization would be needed for a detailed interpretation of these latter differences. At the moment we have to be satisfied with the statement that *the ego involving aspects of young children's fantasy stories may reflect much more of their family value system than of their creative potentials.*

Spontaneous creative activities

In the fourth year a questionnaire consisting of 81 items on leisure time creative activities was filled out. Much to our surprise, the average selection of items showed a mirror image of the results obtained with the creativity tests. Children were instructed to select those activities that they had performed on their own initiative during the given school year, with no obligation or assignment to do them. The average number of items selected in the four groups was the following: MH = 24.4, NMH = 36.2, ML = 36.6, NML = 40.7. The High SES children attending music classes selected much less activities than the others ($Chi^2 = 10.93$, $p < 0.001$) who did not differ from each other. The most striking aspect of this result is the variety of leisure time activities found in the Low SES group receiving no special

education. In order to interpret this result, an item per item analysis was performed.

For the majority of the items there was a significant difference between the groups. Some of these differences are certainly accidental as they might have been caused by the temporary preoccupation of the children in a given class around the time of the testing (both inside and outside school). Many of the differences found proved to be systematic with respect to the questions studied here, and so they may account for the overall difference between the groups.

Social status proved to be the prime and most characteristic determiner of spontaneous creative activities. Low SES children report significantly more frequently the following activities, than do High SES children (listed here in the order of decreasing general frequency in the four groups): mixing colours, collecting newspaper cuttings, making wood carvings, drawing illustrations for a story, preparing weather reports, decorating a bulletin board, flying a kite, caring for pets, making clay figures, writing recipes, constructing musical instruments, helping out at home, preparing coctail recipes, constructing explosive devices, fixing something in the school, planning an experiment.

Thus, children coming from families of lower social status tend to become engaged in more practical, material activities than their higher social status peers. The only activity which showed a reverse tendency was social in nature: holding some position in a child group or team was reported more frequently by High SES children. This picture is reinforced if we take a look at those activities in which all the groups taken together report more participation than the most privileged MH group. These are the following: cutting out paper animals, making a toy for small children, drawing a map, collecting bugs, performing a story, dissecting animals, painting the family, weaving decorative baskets, playing historical games, grafting a plant, making posters, drawing a map of the neighbourhood. Here, again, practical constructive activities, crafts and activities connected with "nature" dominate. In contrast, the only activity that was reported more frequently by the most privileged MH group was puppetry.

The Low SES group participating in musical education was especially superior to the other groups in certain activities which may indicate the effects of musical education (writing a song, creating a

dance, playing theater, reading popular science magazines). At the same time, the specific, preferred activities (besides the ones associated with social status) of the Low SES group with no musical education do not show any consistent pattern (story writing, airplane modelling, drawing greeting cards, making leaf prints, performing). In the case of Low SES children participating in Kodály's training, the effect of educational experience shows up even more clearly if we combine the four items related to the spontaneous use of music (writing a song, singing a song, making up a tune, creating a dance). The mean value of selecting these activities in this group was 1.3, while the means in the other groups were: MH = 0.4, NMH = 0.8, NML = 0.4.

The High SES group in the Kodály school probably shows this low level of spontaneous creative activity in connection with music and in other respects simply because these children have very little spare time (almost every afternoon they go back to school for choir practice or an instrumental music class) and their musical interest is thus satisfied within this organized framework. The high frequency of selection of music-specific items in the Low SES group participating in special musical training is a very positive symptom of the effect of musical education on spontaneous activity.

The general effects of social status on the spontaneous activities of children seem to support the commonly held view that in higher status families children are kept too busy with school and extracurricular organized activities (private lessons, etc.), thus reducing their opportunities to engage in "genuine" childhood creative activities. There are two uncontrolled factors, however, that should make one cautious when interpreting this finding. First, there might be a bias on the part of lower status children towards responding positively to the questions, or, put differently, higher status children may have used stricter criteria in item selection. Secondly, the items in the questionnaire may not have been representative of all the spontaneous creative activities of the children. Thus, for example, those verbal and social activities which are characteristic of the subculture of higher status children may very well have been underrepresented in our questionnaire. However this may be, since the differences were not random at all, one thing seems to be certain: *lower SES children engage in more creative activities connected with crafts and nature than do their higher SES peers.*

An interesting question is raised by the fact that the rich, spontaneous creativity of the lower status group not participating in special musical education is accompanied by a rather poor performance on creativity test. One explanation for this apparent contradiction might be that creativity tests, regardless of their playful nature, are task-like and therefore far more restrictive than the activities listed in the questionnaire. This would suggest that these children are at loss when they are required to use their creative potentials in organized, task-like activities. Further support for this interpretation will be given later in connection with personality structure.

The high level of spontaneous creativity coupled with a higher performance on creativity tests in the case of the low status group participating in special musical training could mean that the *Kodály method of training provides an opportunity for lower status children to learn how to use their creative potentials in organized, task-like settings.*

Effects of personality

Although the data discussed in the foregoing have already indicated some differences between the groups that are not strictly intellectual in nature, our main sources of data for the possible effects of the Kodály method of musical education on the development of personality were the *Rorschach protocols* of the fourth year.

This inkblot test consisting of 10 plates was introduced to the psychodiagnostic practice by Hermann Rorschach in 1921, and is a very widespread instrument for the complex diagnosis of personality ever since. We used the rich data provided by the protocols only for comparing groups, and no attempt was made to prepare an exhaustive personality profile for each child. Let us first examine the general quantitative characteristics of the answers as indicated in Table XIII.

One protocol in the ML and three in the NML class were unanalyzable and were therefore excluded from all comparisons.

Children belonging to the MH group produced more answers than the others, just as they proved to be the most fluent in the creativity tests. Comparing the number of subjects giving up to 30 or more

Table XIII. Group means of general characteristics of the Rorschach protocols

	MH	NMH	ML	NML
No. of answers (R)	42.3[ah]	32.3	30.1[h]	27.1
Answering time (R/min)	0.5[a]	0.8	0.7	0.8
V % (popular answer)	18.6[a]	35.4	35.9	34.3
Animal cont. %	50	53	56	55
F+ %	76	72	83[k]	81[k]

answers a very significant difference was obtained between them and the other three groups ($Chi^2 = 12.51$, $p < 0.001$). However, although the group means in Table XIII do not indicate this, among the children producing many answers, the Low SES Music group proved to be very fluent, too. 43% of their protocols contained more than 30 answers, while in the NMH and NML groups this percentage was lower, 28% and 26%, respectively. In the two groups participating in special musical training there were more children producing long protocols than in the two control groups ($Chi^2 = 10.81$, $p < 0.001$).

The MH group also responded faster than the others: the number of children requiring less than 30 seconds for one answer was significantly higher in this group than in the others ($Chi^2 = 8.88$, $p < 0.01$).

The greater originality of the MH group found in the creativity test, was also observed here. The *percentage of vulgar (popular) answers*, indicating a stereotyped stream of thought, was rather low in this group. (Answers with a frequency over 7% in the general population belong to this category.) Specifically, 96% of the children in this group had less than 30% popular answers in their protocols, which differs significantly from the other three groups ($Chi^2 = 22.41$, $p < 0.001$).

In the percentages of *Animal contents*, which is another indicator of stereotyped thoughts in the adult population, much fewer differences were apparent between the groups. In accordance with Mérei's findings (Mérei, 1979), the values were in general rather high (half of all the contents in all groups were animals). This corresponds to the increased behavioural stereotypy of preadolescence. In considering

only the most extreme cases, however, there was a tendency in the MH group to show less stereotypy ($0.10 < p < 0.05$). While in this group only 7% of the children gave over 70% Animal responses, in the other groups this value was around 20%.

The ratio of the answers showing a *good form*, as compared to all the answers directed by the form of the inkblot (F + %), presented a rather surprising picture. Lower SES children were much more likely to have a value of this indicator over 80% than the others ($Chi^2 = 8.64$, $p < 0.01$). This is a rather interesting result in the light of the fact that this ratio is usually interpreted as an indicator of mental control and is correlated with intelligence. In our study, however, as we have seen, the High SES groups showing a lower F + %, at the same time obtained higher intelligence scores. This apparent contradiction might be a result of the differences in the respective number of responses given: lower status children gave fewer but better-controlled answers, while higher status children, reacting more freely and in a more energetic fashion, could "afford" a greater looseness of form among their more numerous responses. Thus, at this age a higher F + % may very well mean overcontrol rather than simply mental control. Some further aspects of the protocols also seem to support this view.

Of the response characteristics usually associated with *apprehension type* in clinical practice, only certain basic indicators were analyzed. This aspect of the analysis is concerned with the question of which parts of the figures are given an interpretation by the subject: a detail or the whole, the figure or the white background, etc. The absolute number of these characteristics is then compared to the number of answers given by the subject, in order to obtain the indices of the apprehension type. Table XIV shows the percentage values for three of the most characteristic indices of our groups.

Here and in the following the English notations described by Exner (1974) are used, but their traditional German equivalents are also given in parentheses.

Children in the NMH group gave both more *W* (whole figure) ($Chi^2 = 3.90$, $p < 0.05$) and more *S* responses (using the white background, space of the plates) ($Chi^2 = 6.20$, $p < 0.05$) than the other groups. According to the conventional interpretation of these indicators, children in this group are more ambitious and energetic.

Table XIV. Some characteristic differences in the standardized values of the apprehension type in the Rorschach test (% of subjects)

	MH	NMH	ML	NML
W (G)	68	93	75	68
S (zw)	10	62	25	35
Do	7	14	20	52

Later on we will see that this is characteristically related to the intellectual achievement of these children.

The number of *Do* responses proved to be a very interesting indicator. A response is categorized as *Do* when the subject interprets only a detail where usually a larger unit of the plate is included in the interpretation. (E.g., he sees a human head instead of a whole human figure.) This type of answer appeared much more frequently in the Low SES group not participating in special music education, than in the other groups ($Chi^2 = 13.65$, $p < 0.001$). This can be interpreted as a sign of stronger intellectual inhibitions in these children, inhibitions which are rather widespread at this age (Mérei, 1979). With regard to the main problem of our investigation, it is a very important result that this inhibition was not connected to social status, but rather it was related to participation in the special musical program (ML *vs* NML $Chi^2 = 4.74$, $p < 0.05$).

In the analysis of the so-called response *determinants* the coding identifies those aspects of the inkblots which determine the interpretation (form, colour, shading, or projected movement). Table XV shows both the percentage of occurrences of these response types and their mean frequency in the different groups.

In some cases not absolute appearances but the proportion of protocols over a certain value of the given code is represented.

In the proportion of *movement responses* no significant differences were found between the groups. There was a tendency to give fewer human movement (*M*) responses in the less privileged NML group. The protocols of the NMH group, however, tended to contain more animal movements (*MF*) than those of the other groups ($Chi^2 = 2.76$, $0.10 > p > 0.05$). This might be interpreted as a stronger tendency

Table XV. Occurrence of different types of response determination in percentages and the group means of determiners

Determiner	MH		NMH		ML		NML	
	%	M	%	M	%	M	%	M
M (B) > 2	32	1.2	28	1.2	33	1.3	19	1.0
MF (BF) > 5	18	2.1	34	3.2	19	2.3	17	2.0
F, C (FFb)	46	1.5	79	2.3	85	2.8	70	2.6
C, F (FbF)	86	3.3	59	1.9	40	0.5	43	1.2
C (Fb)	7	0.1	24	0.3	35	0.5	48	0.8
F, Sh (FHD) > 2	16		41		70		61	
Sh, F (HdF) > 2	39		17		40		26	

toward identification. This general tendency, however, characterized all the groups (see the larger number of animal movements), and is a general characteristic in this age group (Mérei, 1979).

The *determinants related to colour* distinguished between the groups in a very characteristic manner. The group attending the Kodály school (MH) gave significantly fewer responses of the type where form is the primary determinant but colour also plays a role in the interpretation (*F, C* (FFb), $Chi^2 = 7.23$, $p < 0.01$), but at the same time, they gave more responses directed by colour but modulated by form than the other groups (*C, F* (FbF), $Chi^2 = 15.57$, $p < 0.001$). This latter effect is probably partly related to social status: while the MH group produced more *C, F*, responses than its social control group ($Chi^2 = 5.18$, $p < 0.05$), the two High SES groups gave very significantly more responses belonging to this category than the two Low SES groups ($Chi^2 = 9.56$, $p < 0.01$).

The two High SES groups gave much fewer *pure Colour responses* (*C* (Fb)), an indicator of impulsive-emotional reactions, than did the two Low SES groups ($Chi^2 = 8.45$, $p < 0.01$). But this was mainly due to the large proportion of such responses in the less privileged NML group. The ML group took an intermediate position in this respect, as indicated by the fact that by itself it did not produce significantly more of these responses than the two High SES groups ($Chi^2 = 3.30$, $p < 0.05$).

These combined effects of social status and musical training on the different responses involving colour can also be seen in Figure 9.

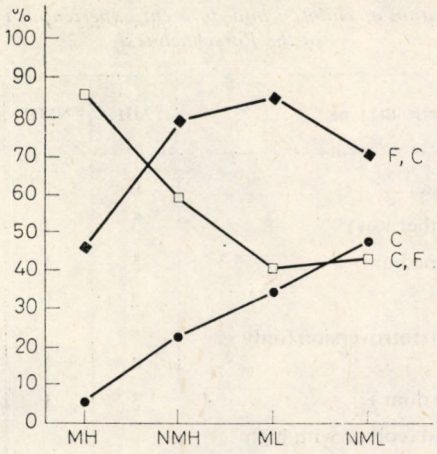

Figure 9. Proportion of children with different types of reaction to colour in the four groups in the Rorschach test (C = pure colour reaction; C, F = colour modulated by form; F, C = form modulated by colour)

Music and social position both tend to decrease the proportion of the most primitive type of response given to colour, while they have a more complex influence on responses combining colour and form in their determination. The most distinguishing colour response of the High SES group participating in musical training is the sensitive-emotional and, at the same time, elaborative *C, F* response, while in their social control group and Low SES peer group exposed to musical training, more controlled and less emotional reactions are the most characteristic.

Shading responses are usually interpreted in the Rorschach test in connection with anxiety and caution. The only noteworthy difference between our groups in this respect was that the two groups participating in musical training produced more *Sh, F* responses indicating anxiety than the other groups ($Chi^2 = 4.046$, $p < 0.05$). This difference however, should not be interpreted in isolation from other aspects of the same protocols.

On the basis of raw data on the determiners, different *relational indices* usually applied in the Rorschach practice were computed. These indices classify the subjects into different personality types by

Table XVI. Distribution of children into different experiential types on the basis of the Rorschach test

Experiential type	MH	NMH	ML	NML
Coartation (both low)	0	1	3	2
Coartative (both rather low)	3	7	5	3
Ambiequal (both medium)	5	3	3	6
Dilated (both high)	2	1	0	0
Extraversion with no introversion (only colour)	4	4	2	4
Extraverted (colour dom.)	3	3	3	5
Balanced extraverted (colour with high movement)	4	4	1	0
Dilatative extraverted (high colour, high movement)	3	3	0	2
Introversion with no extraversion (only movement)	1	0	0	1
Introverted (movement dom.)	1	3	2	0
Balanced introverted (movement with high colour)	2	0	1	0

comparing the number of determinants connected to theoretically opposed reaction tendencies. Table XVI shows the distribution of our subjects according to different *experiential types*. This indicator is a weighted proportion of primary movement responses and colour responses, and is taken as an indicator of introversion *versus* extraversion.

Children were dominantly extraverted in all groups. However, the proportion of children with a so-called balanced or dilatative extraverted ratio (colour dominance accompanied by human movement responses) was significantly greater in the two High SES groups ($Chi^2 = 4.23$, $p < 0.05$).

The most privileged MH group had one very clear advantage over the other groups in the determination of the stream of images in this projective task: there were significantly less children in this group

with emotionally impoverished reactions (coartation and coartative tendency, $Chi^2 = 4.01$, $p < 0.05$). Values of the secondary formula, relating secondary movement responses to achromatic colour reactions (as summarized in Table XVII) indicated a similar tendency. Kinesthetic dominance characterizes higher status children more frequently ($Chi^2 = 5.19$, $p < 0.05$). This may indicate a stronger and earlier tendency on the part of High SES children to use intellectual elaboration which is characteristic of adolescents (Mérei, 1979).

One further aspect of the data shown in Table XVII should be mentioned here. While in the two music groups the number of children showing kinesthetic and sensorial dominance was roughly equal, in the two other groups this was not the case. In the High SES group kinesthetic, in the Low SES group sensorial dominance prevails. We shall return to the possible significance of this finding.

Table XVII. Proportion of children with different secondary movement and colour ratios (secondary formula)

Secondary formula	MH	NMH	ML	NML
Dull (both low)	15	17	15	22
Sensorial dominance	30	7	25	32
Kinesthetic dominance	35	48	20	14
Strained (both high)	20	28	40	32

In the analysis according to *impulse type*, the reactions to white spaces suggesting independence, agressiveness and ambition are compared to the use of shading as a determiner of interpretation indicating anxious tensions. As shown in Table XVIII, higher SES

Table XVIII. Proportion of children with different "impulse type" ratios (ratio of space and shading responses)

Impulse type	MH	NMH	ML	NML
Dull (both low)	21	21	40	30
Space dominance	32	34	5	9
Shading dominance	21	14	30	26
Strained (both high)	27	31	25	35

children showed a stronger tendency toward white space dominance ($Chi^2 = 8.46$, $p < 0.01$) implicating their higher ambitions, which was already mentioned in connection with the white space responses, too.

A summary of the differences in personality

Analysis of the Rorschach tests suggests that the high social status group receiving special musical education excels in giving many responses, and in the originality and emotionality of their responses. There are less children in this group with an emotionally poor and dull response set. The kinesthetic dominance in secondary movement reactions and the high frequency of white space dominated (*S*) impulse types in both of the High SES groups suggest an earlier development of experience elaboration and the presence of more energetic, ambitious children in these groups. The relatively low F + % in this social group might be explained by the fact that since these children have a more inquisitive mind and are achievement oriented, they take more chances in interpreting the plates. This results in a relatively larger number of less than perfect responses given to the plates.

Few and slowly produced responses characterize the other extreme group (NML). These comprise a large proportion of good form responses implying strong mental control. An interpretation of this, also supported by the higher number of *Do* responses suggesting strong inhibitions, might be that children in this group, when confronted with an adult, become inhibited in their fantasizing even in an only marginally task-like situation. This gives further support to our explanation for the discrepancies between the results of the creativity tests, on the one hand, and spontaneous creative activities, on the other, for this group. At the same time, signs of uncontrolled impulsiveness also appear in this group in the form of pure colour responses.

From an educational point of view, our critical group is, of course, the one with lower status children receiving special musical training. Children in this group in many respects show similar personality traits as their social controls. There are, however, some differences between them which point to the positive influence of musical education on personality development. In the ML group more children give a

relatively large number of responses (over 30), and, at the same time, this more fluent responding does not impair the form-quality of their answers. A very positive indicator is the finding that this group, just as the High SES children, gave only a small number of responses of the type implying intellectual inhibitions *(Do)*. There is, however, a contrast between the two music groups with regard to responses involving colour. Low SES children participating in Kodály's musical training produced the highest number of form–colour responses, while High SES Music children the least. Concerning colour–form responses, the situation is just the opposite: Low SES Music children produced the smallest number of this type of response, while their High SES peers receiving musical training produced the most. This suggests that controlled affectivity is more characteristic of the ML group than of the MH group. While this latter difference might be subject to different interpretations, it seems certain that the ML group's affectivity is more controlled than that of their social control peers who produced pure colour responses much more frequently (see Figure 15). The relatively large number of children with a coarted–coartitive type of experience and dull impulse type in the Low SES group participating in musical training indicates inhibitions caused by task situations. It seems possible that the children in this group are at ease in certain types of tasks (e.g., in tests of creativity), while in other situations their constructiveness might be inhibited. These socially conditioned inhibitions and the range of the possibly inhibiting situations, however, are clearly much reduced in their case, due to the effects of musical education.

Changes in the relationship between creativity, intelligence and social status under the influence of musical education

The analyses presented up to now have already shown the importance of social status in the determination of performance on intelligence tests, as well as the possible compensatory role of musical education with regard to the creativity of lower SES children. The same type of question can also be raised in connection with the children individually: *does musical education have an effect on the correlations usually found between social status and intelligence, and does it have*

Table XIX. Spearman's rank correlations between social status and intelligence in children studying according to the Kodály method and in children attending regular classes

	Kodály's musical (MH+ML) training	Regular (NMH+NML) classes
2nd year–IQ	0.366**	0.366**
4th year–IQ	0.284	0.730***
4th year–VQ	0.317*	0.608***
4th year–PQ	0.147	0.752***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
In the second year ranking was based on the sum of raw scores of the partial intelligence test.

an effect on the non-correlation between social status and creativity mentioned in the introductory chapter?

In order to answer these questions, first the *correlations between intelligence and social status* (as measured by the index described in connection with subject selection) were compared in the music and no music groups. The two music and no music groups were combined, as indicated in Table XIX, in order to study these correlations using a wider range of social status than our separate groups would permit. (Both combinations pair one group with a low mean and one with a high mean status on the status index.)

The interesting aspect of these correlations, from our point of view, was that the initially already significant but rather low correlations in the no music group became in general strengthened during the years spent in school, while under the influence of special musical training they were not. (The correlations of the 4th year were also significant in the two groups attending regular classes when taken separately, NMH = 0.463, NML = 0.575. In the two music classes, however, when examined separately, these correlations were, of course, far from being significant.)

The different behaviour of the verbal and practical subtests deserves special consideration. Let us recall that in the group comparisons there was some indication to the effect that practical intelligence was,

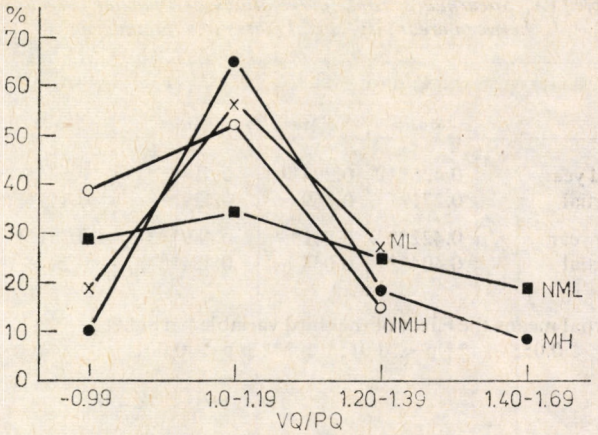

Figure 10. Proportion of the different VQ/PQ ratios in the Wechsler Intelligence test

as expected, less clearly determined by social status than verbal intelligence. The correlations seem to imply that the *relationship between intelligence and social status is specifically weakened under the influence of musical training in the field of practical intelligence.* Comparison of the two Low SES groups indicated this tendency even more clearly. While the social status–PQ correlation was 0.646^{+++} in the regular class, it was -0.144 in the low status music class. (In contrast, in the verbal sphere both classes showed a significant within-group correlation with social status: 0.470^{+} and 0.435^{+}, respectively.)

Further analysis has confirmed this impression. The ratio of VQ to PQ was computed, and below 1 it indicates a relatively higher practical intelligence and over 1 a relatively higher verbal intelligence. The distribution of this ratio in the different groups is shown in Figure 10.

The Figure suggests that in the two music groups the values cluster around 1 showing a balance of verbal and practical intelligence. In the NMH group, on the other hand, a relatively higher practical intelligence was found more frequently, while in the NML group there was a tendency for both extremes to appear.

Both of these differences were significant: in the two music groups more children belong to the middle region of the distribution

Table XX. Spearman's rank correlations and partial correlations between creativity, social status and intelligence

	Creativity—SES		IQ—Creativity	
	Music	No Music	Music	No Music
2nd year	0.425**	0.294	0.518***	0.506***
Partial	0.271	0.169	0.429**	0.447***
4th year	0.422**	0.301*	0.489***	0.381**
Partial	0.404**	0.058	0.424**	0.247

Partial means the effect of the third variable partialized
* $p < 0.05$; ** $p < 0.01$; *** p $p < 0.001$

of this ratio (1–1.19) than in the NML groups ($Chi^2 = 4.589$, $p < 0.05$), and in the NMH group the distribution of the categories was less symmetrical than in the musical groups ($Chi^2 = 6.575$, $df = 2$, $p < 0.05$). Thus, it appears that *musical education reduces the extreme differences between verbal and practical (visual-spatial) performance and works for a more equilibrated structure of intelligence.*

A combined creativity measure was computed to study the *relationships between creativity, social status and intelligence.* The first step in the derivation of this index was the ranking of the summary raw scores obtained in all creativity tests with regard to fluency, flexibility and originality. Then the sum of these rank values was computed for each child, and these sums were re-ranked to obtain creativity rankings combining all three factors. To our great surprise, correlations between creativity and social status, as well as between IQ and creativity were much higher than expected. As shown in Table XX, the correlations between SES and creativity were actually higher in the music group than those between SES and IQ. Furthermore, as shown by the partial correlations, the correlations between SES and creativity have actually increased over time. In the no music group this relationship was weaker if both classes (NMH and NML) were considered together. When treated separately, however, the finding of no-correlation was actually true only for the higher status group attending regular classes (in the NML group correlations were around 0.50).

Table XXI. Rank correlations between creativity and intelligence within different regions of intelligence in the 4th year

IQ	Under 100	100–115	116–125	126–135	over 135
IQ–creativity	0.497	0.173	0.250	−0.118	−0.192
n	10	18	28	17	15

Thus, musical education seems to have an unexpected effect: *it strengthens the otherwise weak relationships between creativity and social status*. One possible interpretation for this finding might be the following. Since the Kodály method emphasizes creativity, social influences tend to appear in this area through an easier accommodation on the part of relatively higher status families to the values preferred by the school. This interpretation is contradicted, however, by the fact that between the two lower status groups attending regular classes, higher correlations were obtained between creativity and social status in an educational climate not favouring creativity, in all but the last year. Thus, the explanation has to be sought elsewhere.

One source of possibly useful information in this regard is provided by the relationship between creativity and intelligence in the two groups. As the right hand side of Table XX shows, this relationship was stronger in the music than in the no music groups. (This effect was already mentioned in connection with the correlations between the separate creativity tests and IQ, as presented in Table XX and Figure 10.) To see whether our sample deviated from the generally found principles governing IQ–creativity correlations (i.e., the lower the IQ, the higher the correlations; Guilford, 1967), we computed correlations for different IQ regions, too. As shown in Table XXI, the general trend of our data is consistent with the literature: the relationships weakened as intelligence increased.

In order to analyze further the difference found in the creativity–intelligence relationship for children participating and those not participating in special musical education, both IQ and creativity distributions were divided into 10 groups of roughly equal size for the whole sample. We then assigned number 1 to the best and number 10 to the poorest group, and from this we computed an intelligence–

Table XXII. Distribution of the creativity/intelligence category ratios in the 4th year

Creativity/IQ ratio	MH	%	NMH	%	ML	%	NML	%
0.1–0.75	6	21	17	63	2	9	7	29
0.76–1.99	16	57	6	22	13	59	14	58
Over 2	6	21	4	15	7	32	3	13

creativity ratio for each child. If this ratio is over 1, the subject's creativity is higher than his intelligence, while if it is less than 1, it is his intelligence that is relatively higher. Table XXII shows the distribution of this ratio in the four groups. The differences between the groups were very clear: the Chi^2 computed from Table XXII was 17.28 ($df = 6$, $p < 0.01$).

Table XXIII, summarizing the separate comparisons between the groups, provides a clear explanation of this difference. In the groups attending special music classes there were much fewer children who reached a lower level of creativity than expected on the basis of their intelligence. Thus, imagining a scattergram of the two variables, the lower correlation in the no music classes can be seen as specifically due to deviations from the regression line towards lower creativity.

The equalization between intelligence and creativity is very characteristic of the highly intelligent children in the music group. High IQ (categories 1 to 4) accompanies high creativity in 15 cases, and medium or low creativity only in 2 cases in this group. The correspond-

Table XXIII. Chi^2 values of the comparisons between groups of the number of IQ/creativity ratios below and over 1

	MH	NMH	ML
NMH	8.05**		
ML	n.s.	7.75**	
NML	4.66*	n.s.	4.81*

ing ratio in the no music group is 10 : 13, and this difference between the two groups is significant ($Chi^2 = 6.55$, $p < 0.05$).

The influence of musical education, however, is not restricted to the group of highly intelligent children. In the music groups low IQ (categories 7 to 10) was more frequently associated with medium level creativity than in the low intelligence subgroup of the no music group (9 *vs* 0, $Chi^2 = 4.90$, $p < 0.05$).

These data support the idea that *musical education helps to increase creativity to a level corresponding to the children's level of intelligence, and even to surpass it*. These effects may very well be the main factor underlying the surprisingly high correlations between creativity and intelligence, on the one hand, and between creativity and social status, on the other, in the music groups. The increasing correlations probably accompany the general increase in creativity under the influence of musical training.

Thus, a tentative general conclusion of the correlational studies might be the following. Under the influence of musical education the product side, that is, the inherent content of the tests becomes more important than the presentation medium (visual–verbal) itself in the determination of relationships between different tests of creativity. While musical education does not increase intelligence as measured by traditional intelligence tests, the data suggest that it leads to a more balanced structure of mental abilities, a more harmonious relation between verbal and practical intelligence, as well as between intelligence and creativity. These implications might be specific to our sample. If they are supported by further research, however, they can indicate important possibilities for music to effect the very structure of abilities. Some similar suggestions about the possible harmonizing effects of music will be presented in the following.

Relationships between personality and intellectual performance, and the effects of musical education on these relationships

In connection with the analysis of the Rorschach protocols, it was already mentioned that higher intellectual performance might be related to different personality constellations in the musical and non-musical groups. In this section a more systematic analysis of this suggestion will be attempted.

Table XXIV. Contingencies of intelligence and creativity with R and content domains in the Rorschach test (in percent)

Intellect categories	8–10		5–7		1–4	
	Creat.	IQ	Creat.	IQ	Creat.	IQ
Number of answers						
Under 25	69	41	38	36	26	46
26–40	31	35	41	46	41	35
Over 40	0	24	21	18	23	19
Number of content domains						
3– 6	38		18		3	
7–10	35		46		34	
11–14	23		18		37	
15–20	9		18		26	

First, we shall examine the relationships between those indicators of the Rorschach test which attempt to express such characteristics of the stream of thought that are, to some extent, similar to those *creativity tests* deal with. Table XXIV presents the contingencies of the creativity and IQ categories, and the number of responses and content domains in the Rorschach test. While both the number of responses and content domains increased with creativity ($Chi^2 = 22.22$, $f = 4$, $p < 0.001$, and $Chi^2 = 15.93$, $f = 6$, $p < 0.05$), they were not significantly related to IQ ($Chi^2 = 1.50$, n.s., and $Chi^2 = 11.28$, $f = 6$, $0.05 < p < 0.10$), though there was a tendency for the number of content domains to increase with IQ. This supports the use of these indicators as rough measures of creativity.

It is of more specific interest to us that the proposed *indicators of emotional sensitivity and dynamism in the Rorschach test tend to show a different relationship with intellectual achievement in the music and no music groups*, respectively. The *C,F* (FbF) responses (colour modulated by form), indicating elaborated emotional reactions (which, as we have seen, were most frequent in the MH group), were found to be related to creativity in the whole sample. While creativity increased with the number of *C,F* responses ($Chi^2 = 14.45$, $f = 4$, $p < 0.01$), intelligence did not ($Chi^2 = 5.68$, n.s.).

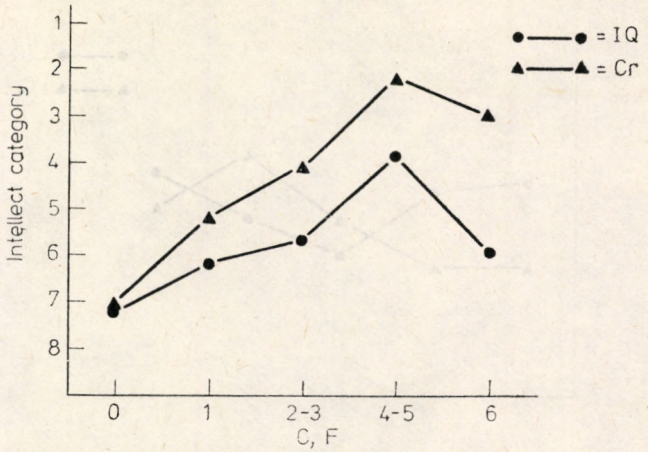

Figure 11. C, F responses in the Rorschach and intellect categories in the music classes

However, if we treat the music and no music groups separately, it turns out that it is the children taught by the Kodály method who were "responsible" for this difference. And, as shown in Figure 11, while in their case creativity did increase with the number of *C,F* responses ($Chi^2 = 12.8$, df = 2, $p < 0.01$), in the groups attending regular classes it did not ($Chi^2 = 0.52$, n.s.). The same holds for IQ, as shown in Figures 11 and 12. Although IQ was not related to colour reactions in the entire sample, in the group receiving musical education it was ($Chi^2 = 9.23$, f = 2, $p < 0.01$). On the basis of these differences one can suggest that under the influence of musical education *emotional sensitivity and intellectual effectivity somehow become integrated.* Furthermore, since this relationship is clearer concerning creativity, and since the relationship between creativity and IQ is stronger in the music groups, one can also suggest that the leading mediating factor in this integration is creativity, and so affective sensitivity becomes integrated first of all with creativity.

Turning to the number of *S* (zw) answers, which imply a dynamic and ambitious attitude, we can see that the situation is basically a "mirror image" of the one described above. As we have seen, this type of response, interpreting the white background rather than the figures of the plates, was the most frequent in the NMH group.

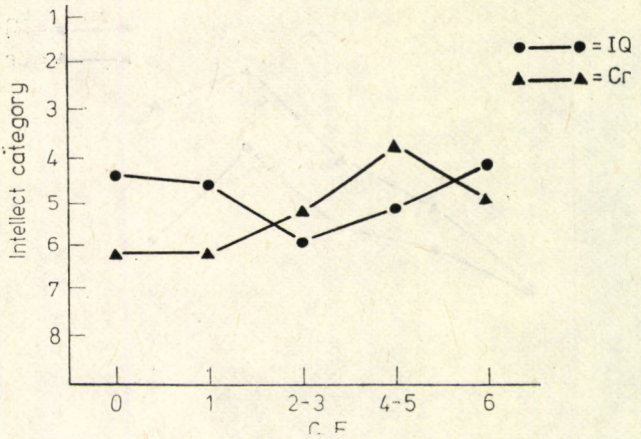

Figure 12. C, F responses in the Rorschach and intellect categories in the no music groups

Table XXV shows that creativity increased with the number of *S* responses ($Chi^2 = 11.15$, $p < 0.05$, $df = 4$); 80% of the highly creative children have given at least one *S* answer, while in the least creative groups this proportion was only 53%. At the same time, the number of *S* responses was not related to IQ ($Chi^2 = 5.68$, $f = 4$, n.s.). In the present case, however, the overall difference found was mainly due to the no music group.

As indicated by the lower half of Table XXV, the difference in the number of *S* responses between high and low creativity was significant for the group attending regular classes ($Chi^2 = 8.94$, $f = 2$, $p < 0.05$), but in the case of children taught by the Kodály method, it was not ($Chi^2 = 4.38$, n.s.). The main difference between the two groups was that in the music group there were more highly creative children not producing any *S* answers in the Rorschach test. One might suggest that the basis of the difference is that in children participating in the musical program an increased energy activation is not a necessary component of creativity.

Creativity, in their case, goes together with emotional sensitivity. In the case of children attending regular classes, a dynamic background of creativity is provided by increased activation and energy mobili-

Table XXV. S (white space) responses in the Rorschach test according to creativity groups (in percent)

Whole sample			
S (white space)	0	1–3	4–
1–4 high creativity	18	42	40
4–6 average creativity	21	52	27
8–10 low creativity	46	46	8
Music group			
1–5 high creativity	26	33	41
6–10 low creativity	36	50	14
No Music group			
1–5 high creativity	15	38	47
6–10 low creativity	30	60	10

zation. (For a general interpretation of *S* answers along these lines, see Szakács, 1980.) In more casual terms one might suggest that *the creativity of musically trained children is of a softer kind, while that of the control groups is of a more energetic type.*

However, it is important to mention here that the number of white space responses was most clearly related to the social status of the child. As shown by Figure 13, the indicator of average social status increases with the number of *S* responses ($Chi^2 = 23.50$, $f = 4$, $p < 0.001$), and this is true both for the music and no music groups ($p < 0.01$ in both cases). Thus, independently of musical education, *children of higher social status tend to be more ambitious and energetic.*

The third important indicator of dynamics, the *number of M+ (B+, human movement with good form) responses, was also clearly related to creativity.* Table XXVI shows that creativity increased with the number of *M+* responses ($Chi^2 = 13.64$, $f = 4$, $p < 0.01$). Such a relation did not hold for intelligence ($Chi^2 = 4.21$, n.s.).

The *M+* – creativity relation was, however, different in our two main groups. If we compare Figures 14 and 15, we can see that the

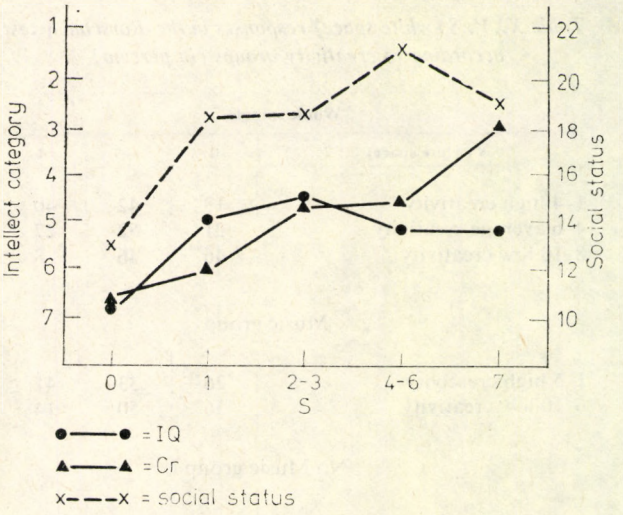

Figure 13. Relationships between S (white space) responses in the Rorschach, and intellect and social categories

tendency was clearer in the case of children participating in special musical education ($Chi^2 = 8.34$, $f = 2$, $p < 0.05$), in the regular control groups it only approached significance ($Chi^2 = 5.32$, $f = 2$, $p < 0.10$). Furthermore, in the music group human movement interpretation exhibited an almost significant relationship with IQ ($Chi^2 = 5.67$, $p < 0.10$), while in the no music group this contingency, mostly due to the relatively higher intelligence of children with no $M+$ answers, was totally missing ($Chi^2 = 0.21$).

Table XXVI. The distribution of M+ (human movement with good form) responses in the Rorschach in the different creativity categories (in percent)

M+	0	1	2–
1–4 high creativity	8	33	59
5–7 average creativity	32	34	34
8–10 low creativity	27	54	19

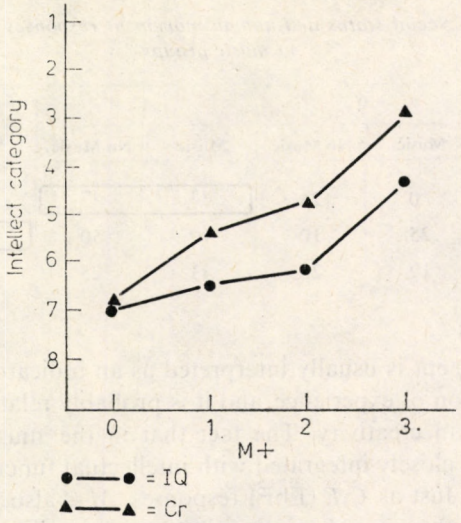

Figure 14. Relationships between M+ (human movement) responses in the Rorschach and intellect categories in the music groups

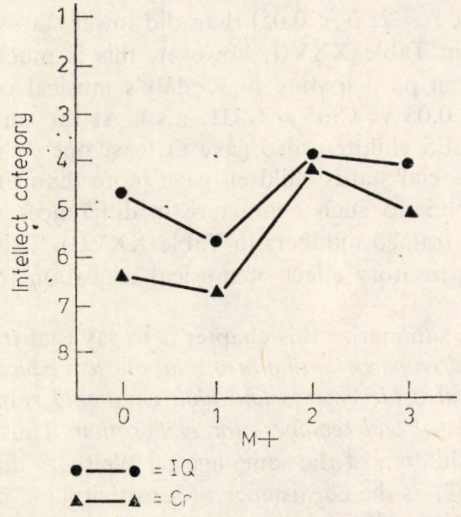

Figure 15. Relationships between M+ responses in the Rorschach and intellect categories in the no music groups

Table XXVII. Social status and human movement responses in the music and no music groups

$M+$	0		1		2—	
	Music	No Music	Music	No Music	Music	No Music
5–13	0	26	83	47	17	27
14–21	25	10	10	50	65	40
22–31	19	25	43	25	38	50

$M+$ movement is usually interpreted as an indicator of inner control, elaboration of experience, and it is probably related to the elaboration factor in creativity. The fact that in the music group it has become more closely integrated with intellectual functioning is a very positive sign. Just as C,F (FbF) responses, $M+$ also suggests a more integrated involvement of emotional factors in intellectual functioning, especially in creativity. The appearance of $M+$ responses was also distinctly related to social status in the two groups. In the whole sample, children of medium or higher SES gave more $M+$ responses ($Chi^2 = 6.430$, $f = 2$, $p < 0.05$) than did lower status children.

As shown in Table XXVII, however, this is much clearer in the case of children participating in Kodály's musical training ($Chi^2 = 4.768$, $p < 0.05$ vs $Chi^2 = 1.831$, n.s.). At the same time, in this group, Low SES children also gave at least one $M+$ response, and intermediate social status children gave more than one, while in the no music group no such characteristic differences were found (as shown by the framed numbers in Table XXVII). This again shows a possible compensatory effect of musical education for social handicaps.

One way to summarize this chapter is to say that *it is more characteristic of children participating in special musical education to combine high intellectual achievements and high emotional responsiveness with high inner control and readiness for elaboration.* Thus, the syndrome described in children of the same age by Weisberg and Springer (see Torrance, 1962) as the coexistence of sensitivity and independence as preconditions of creativity is more prevalent in children receiving special musical education.

Summary and some perspectives

Following the basic purpose of our investigation outlined in the introductory section, we shall try to review our results and their implications with reference to three main problems:

1. The overall effects of Kodály's musical training on the development of intellectual processes and on personality.

2. The possibilities of compensating for cultural handicaps due to socio-economic status through musical education.

3. The effects of musical education and social status on the interrelationships between intellectual abilities and their relations to personality traits.

According to the results obtained with the use of traditional tests of intelligence, the general level of intelligence seems not to be effected by musical education. The higher status groups preserved their superiority in the intelligence quotient over the four years, independently of musical training. On the other hand, the positive effect of musical education on the development of creativity was unambiguous. This effect was evident both in the three basic indicators used in the repeatedly applied creativity tests (fluency, flexibility and originality) and from the analysis of the fantasy stories told by the children.

The positive effect of musical education on creativity also appears in Low SES children. Members of this group not only performed better than their social controls, but in some tests they were even superior to the High SES group not receiving special musical training.

In personality tests, the High SES musical group was found to be superior to its social control, mainly where creativity was concerned. The Low SES Music group also differs from its control in many positive respects, the most important being the lower degree of inhibition in task situations.

While measurements of intelligence showed social factors to have a dominant effect, some important qualitative changes are also shown to take place due to the influence of musical training. The inequalities between verbal and practical intelligence decrease throughout the years in the Low SES children participating in musical education, suggesting that the structure of their intelligence is becoming more balanced. All this implies that musical education might have a pos-

sible compensatory effect in the development of creativity and in the modification of the structure of intelligence.

Correlations between creativity and intelligence also increase due to musical education. According to our analysis of the performance of individual children, this result is due to an increase in the children's creative performance to a level predictable from their level of intelligence. Thus, in the music group the number of children in whose case a relatively high intelligence score is accompanied by low creativity decreases, while in the no music group cases of this kind are more frequent. Musical education tends to produce a more harmonious relationship between creativity and intelligence, divergent and convergent thinking.

With regard to the relationships between personality and intellectual performance, the results suggest that in children more exposed to music high creativity is combined with emotional sensitivity, elaboration and inner control, and they tend to mobilize energy and activity in convergent tasks requiring more disciplined thought. Children attending regular classes, on the other hand, seem to mobilize more energy for the solution of tasks of creativity, possibly because they are rewarded less frequently in such tasks and/or they experience less often the playful joy of solving such tasks in their school life. The solution dynamics of creativity tasks might, however, differ greatly between the two no music groups, too. In the higher status group not participating in musical education, a high energy charge and ambition is an always present characteristic, thus, we might suppose that they become involved with greater energy mobilization in novel situations, too. This set or attitude, however, is not welcome in tasks requiring divergent thinking, and this may be a factor in the lower creative performance of the NMH group.

A different picture might be given to describe the performance of the low status group not participating in musical education. Since in this group there are only a few ambitious, energetic children among the many inhibited ones, probably they also overemphasize the task-like aspects of creativity tests and pay less attention to their playful side. Task situations, however, mobilize in these children failure-avoidance and blocking reactions. This is supported by the very few stories with a negative outcome in this group and by the increased number of responses implying inhibition in the Rorschach test. They

can mobilize their creative potentials probably only in absolutely free situations, as the richness of their free-time spontaneous creative activities indicates.

Thus, in the no music control groups, defensive reactions against ego-involving tasks characterize the Low SES groups, while taking the tasks too seriously characterize the High SES group. In contrast, signs of an optimal tendency can be seen in the music groups. Energy mobilization is characteristic of them only in situations requiring disciplined thought, but they are able to relax, take a playful stand, adapt to the different requirements of creative tasks, and thus secure high achievement. They may realize this by a more pronounced integrity of emotions, motives and thought, by the development of a more integrated personality. The overall transfer effect of Kodály's musical education might be explained on this basis.

On the basis of our investigations, it would be impossible to give a decisive answer to the question: *how* is all this achieved by the Kodály method. One of the first educational problems involved here is the relationship between general educational interventions and practices specific to the Kodály method. We think that the Kodály method applies procedures and methods of general value besides the specific musical ones. One of the most basic among these is the flexible application and interchange of the stricter, reasoning type strategies and the more playful, divergent strategies of problem solving even within one task. (E.g., analysis and practice of a rhythm in different ways – by singing, clapping, writing, tapping – followed by the creation of a different rhythm.) Thus, there is an overt effort to integrate convergent and divergent thinking, logic and fantasy.

Motivational dynamics is related in a natural way to this variety of intellectual processes, without any specific educational effort towards such an effect. This kind of task organization is not specific with regard to the subject of the curriculum involved, and it can easily become an organizational principle in any area of human knowledge and practice. These aspecific effects of the Kodály method on psychological development might form the basis for its most general educational legacy.

It is an undeniable merit of the Hungarian method of teaching music and singing connected with the name of Kodály, but elaborated in many details by Jenő Ádám, that it was the first to recognize the

value of and to apply these methods, which are useful and successful both from a music-pedagogical and from a general educational point of view.

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This volume presents selected papers by Hungarian psychologists working at the General Psychology Department of the Eötvös Loránd Universty in Budapest.

Most of the studies take as their starting point the psychometric approach to creativity as developed by Guilford and Torrance. However, there is a specific effort to combine psychometric studies with experimental approaches in order to discover the basic mechanisms of creativity. In particular, some papers look for the perceptual characteristics of creative persons, while others study complexity preference in creative and noncreative subjects.

Another central topic of these studies is the personality background of creative behaviour. Several papers examine issues like male/female differences in creativity, masculinity/femininity as a determinant of creativity, personality differences between persons who are actually doing creative work and who score high on traditional creative thinking tests.

The final topic is the issue of educational influences on creativity. A paper summarizing a 4-year longitudinal study shows the effects of intensive early musical education (the Kodály method) on the development of creativity.

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