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KANDINSKY'S QUESTIONNAIRE REVISITED: FUNDAMENTAL CORRESPONDENCE OF BASIC COLORS AND FORMS?[1,2]

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Summary.—Kandinsky postulated a fundamental correspondence between color and form. Using a variant of his historical questionnaire, 200 (92 men, 108 women) nonartist university students were divided into two groups and asked to assign the colors yellow, red, and blue to the triangle, square, and circle in a one-to-one fashion. One group worked under a mere color-form correspondence instruction, the other under an aesthetic-correspondence one, i.e., this latter group was asked to make the most beautiful color-form assignment. Participants' assignments showed a clear, stable group preference. About half of the students assigned red to the triangle, blue to the square, and yellow to the circle, respectively. This preferred assignment stood regardless of variation in instruction. Frequently, world knowledge associations were stated in the rationale for an assignment choice. The red triangle resembled a traffic sign, a warning triangle, and the yellow circle resembled the sun. Kandinsky's assignment, however, was the least preferred one. It is argued that color-form assignments as well as the motivation to produce them are due to a multitude of factors. World knowledge, education, historical change, societal, group-specific, and individual leitmotifs are all influences.

The use of primary colors and forms in the fine arts as well as graphic and industrial design at the Bauhaus was a revolutionary innovation in the early twentieth century. This stemmed from the desire to find basic principles of general applicability in art and design. The goal was to find a universal ideal visual language to be used in various kinds of visual communication. To this end, color and form were reduced to their fundamentals. The yellow triangle, red square, and blue circle, a color-form assignment by Wassily Kandinsky, became a visual theme that was much repeated at the Bauhaus exhibition of 1923. Thereafter, basic colors and forms, and these specific combinations in particular, were frequently used by various artists and designers, became famous, influential in design, and, eventually, promoted by others than Kandinsky himself as symbols for the Bauhaus school of design. Today, the Bauhaus's influence continues and applications of the colors

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and forms can be seen in countless variations (see Poling, 1982/1986; Droste, 1990; Fiedler & Feierabend, 1999/2000, for introductions to various aspects of the Bauhaus).

In his theorizing and teaching, Kandinsky was especially interested in the relation of color and form. To him there was an inherent link between the two that was of a synaesthetic quality (cf. e.g., Poling, 1982/1986), suggesting a general correspondence of color and form (Kandinsky, 1912, 1952). Particularly, he developed the combinations of yellow and triangle, red and square, and blue and circle, respectively. When Kandinsky joined the Bauhaus in 1922, his assignment became widely used (Droste, 1990). It was much in evidence in his teaching of the basic course on color and form (Vorkurs; Kandinsky, 1975) and throughout the school.

There are a number of reports that Kandinsky used an empirical approach to investigate his correspondence hypothesis in 1923 (cf. Poling, 1982/1986; Droste, 1990; Lupton & Miller, 1993/1994). As head of the Wall Painting workshop he conducted a survey. He designed a questionnaire that instructed participants to assign yellow, red, and blue to the triangle, square, and circle and to give a rationale for their choice.[3] The results suggested Kandinsky's correspondence hypothesis. Reports differ, however, with regard to the extent of agreement among participants. Unfortunately, a first-hand documentation is not available. In particular, there is no description of the sample, no unequivocal reports of the sample size, the relative frequencies of the six possible assignments, or the rationales that the participants gave. Note that the sample of participants was most likely a highly selected one, probably consisting largely of Kandinsky's fellow teachers and Bauhaus students who had been taught his color-form assignment.

Subsequently, Kandinsky (1926/1979, 1973) elaborated his correspondence theory. He argued that the fundamental correspondence of basic colors and forms was mediated by the inherent relationships of colors and angles. The acute angle was inherently active and aggressive, as the color yellow. Thus, the triangle, consisting of three acute angles, was yellow. The obtuse angle was akin to blue, rendering the circle blue. The right angle, in between the other two, was red in character. Hence the square was colored red. In this rationale of his correspondence theory, Kandinsky did not mention his 1923 survey or any empirical results. While his model was absolute and universal in theory, he did not preclude that artistic practice, including his own, differed from it. Also, his color-form correspondence theory was not overall predominant in his artistic theorizing. Kandinsky's proposal, how-

[3]Two copies of the original questionnaire (one filled in, one blank) that still exist today are frequently used for illustrative purposes in publications about the Bauhaus. A third, filled-in copy was recently discovered.

ever, was contested. Fellow artists at the Bauhaus held differing views (cf. Poling, 1982/1986), in part prior to Kandinsky's publication (1926). Arnheim considered his correspondence theory a "personal impression" (1974, p. 371). Nonetheless, Kandinsky's color-form assignment and correspondence theory became world-famous and are used to date. Combinations of basic colors and forms are common design usage and a component of contemporary design theory (cf. Droste, 1990).

The Present Study

The present study investigated the hypothesis of color-form correspondence in general and Kandinsky's universal correspondence theory in particular under contemporary conditions. The following questions were investigated. Is there a substantial preference for one assignment over the other possible ones? Does a color-form correspondence exist in general? More specifically, does Kandinsky's universal correspondence theory hold for nonartists today? In addition, the empirical aesthetics of color-form correspondence was investigated in a second condition using an instructional variation, and the temporal stability of participants' assignments was assessed in a test-retest procedure in both experimental conditions.

University students, none of whom had received professional training in the fine arts or graphic design, were asked to fill in an adopted version of Kandinsky's questionnaire. In one condition, a Mere-correspondence instruction, that closely resembled Kandinsky's original, was used. A second condition employed an augmented instructional variation that additionally asked for the most beautiful assignment of colors to forms. Using this procedure, responses to the traditional Mere-correspondence instruction could be compared to an Aesthetic-correspondence instruction.

A recent pilot study, using the present questionnaire under the Mere-correspondence instruction, found a clear preference for the red triangle, the blue square, and the yellow circle [$\chi_1^2(N=35)=8.8$, $p<.01$]. The first was taken to resemble a red triangular traffic sign or warning triangle and the last the sun. These were highly common, everyday associations. Consequently, these assignments probably reflected the use of world knowledge. Kandinsky's assignment was the least preferred one. Based on these results two faces of the alternative hypothesis were derived. In addition to *Kandinsky's hypothesis*, the warning-triangle-sun or *association hypothesis* was set. The null hypothesis was that there was no preference of one assignment over the others.

In case Kandinsky's correspondence theory was supported, there should be high temporal stability of the assignments due to the universal status of the correspondence. A comparable prediction held for the association hypothesis. If there was a clear preference for the association hypothesis, this

was also expected to be temporally stable, provided that the underlying world knowledge association, e.g., colors of warning signs, did not change. On the other hand, if there was no correspondence, assignments might be more prone to change over time. Of course, this might differ individually. It was expected that some participants would show a clear, stable preference and others would have no color-form correspondence. Self-evidently, there might be individuals who firmly favored Kandinsky's assignment.

Method

Participants

Students of the University of Leipzig, a Leipzig college, or junior college (Gymnasium) participated in the study (92 men, 108 women). Their median age was 23 yr. of age (range 17 to 32 years). None of them had received formal training in the fine arts or design, knew Kandinsky's correspondence theory or his color-form assignment, or reported an impairment of color vision or color blindness. They reported a median of 5 above normal interest in the fine arts, graphic design, and architecture. Use of the scale (1 = no interest; 7 = very strong interest) covered the whole range. Additional participants ($n = 2$) who knew the artist's assignment and theory were excluded from the study. In Part II, 58 participants were retested.

Material

A questionnaire was constructed that closely resembled Kandinsky's. Printed in black on white DIN A4 paper, instructions were given on top of the page. Coextensive figures (1.7 cm^2) were arranged in one row: an equilateral triangle, a square, and a circle. Below there was space for the date and a rationale of the assignment. Two additional pages containing questions regarding color-form assignment (reported in the Results section) and personal information (reported in the participants subsection) completed the booklet.

Apparatus

The study was conducted under controlled normal lighting conditions in an experimental room lighted by a ceiling-mounted neon lamp and daylight filtering through drawn gray shades. Participants were seated at a table of light gray color as they completed the questionnaire. "Staedtler Flipchart Marker 35810" felt-tip pens of yellow, red, and blue color were used, i.e., contemporary prototypical primary colors were employed.

Procedure

In Part I of the study, participants were tested individually and were randomly assigned to one of the two conditions. They were given the questionnaire and received the three pens in individually randomized order. They

were instructed to assign the three colors to the three figures on the paper in a one-to-one manner by completely coloring the forms and to provide a rationale for their assignment choices, if they could provide one. In the Aesthetic-correspondence condition, participants were also instructed to produce the most beautiful, the aesthetically most pleasing, assignment (for the use of the word "beautiful" in an aesthetic preference instruction, see Jacobsen & Höfel, 2001; Jacobsen & Schröger, unpublished). They were also asked to give a rationale for their choice, if possible. Furthermore, they were instructed to answer the additional questions on the following pages of the questionnaire after they had finished the first page, asking for the color-form assignments and a rationale. On average, time on task was 11 min. Participants were not informed about a potential second session to avoid deliberate memorizing of the assignment and answers given.

The procedure of Part II was identical to Part I. None of the participants reported merely reproducing the assignment and answers of Part I from memory. There was an average delay of 4.8 mo. between test and retest (range 1 to 12 months).

Results

Part I

The frequencies of the six different assignments that participants made in Part I under the Mere-correspondence and the Aesthetic-correspondence instruction are given in Table 1. The assignment resembling a warning triangle and the sun were the most frequent ones under both instructions. Kandinsky's assignment was the least frequently chosen one under both instruc-

TABLE 1

Frequency of One-to-one Assignments of Basic Colors Yellow, Red, and Blue to Basic Forms of Triangle, Square, and Circle: Parts I and II, Mere-correspondence and Aesthetic-correspondence Instructions

	Condition	Assignment					
		yrb Δ□O	ybr Δ□O	ryb Δ□O	rby Δ□O	byr Δ□O	bry Δ□O
I	Mere-correspondence Instruction ($n = 100$)						
	Frequency	6	18	13	46	9	8
	Aesthetic-correspondence Instruction ($n = 100$)						
	Frequency	4	13	15	46	5	17
II	Mere-correspondence Instruction ($n = 39$)						
	Frequency	2	5	5	20	5	2
	Percent	5	13	13	51	13	5
	Aesthetic-correspondence Instruction ($n = 19$)						
	Frequency	2	1	3	12	0	1
	Percent	11	5	16	63	0	5

Note.—y = yellow, r = red, and b = blue; Δ = triangle, □ = square, and O = circle.

tions. The distributions of assignments did not differ under the two different instructions [$\chi_5^2(N=200)=5.73$, ns]. The distributions of assignments differed from the equal distribution under the instructions, Mere-correspondence instruction [$\chi_5^2(N=100)=67.4$, $p=.001$] and Aesthetic-correspondence instruction [$\chi_5^2(N=100)=70.4$, $p=.001$]. Thus, the alternative hypothesis was accepted, and the null hypothesis was rejected. The frequency distribution of the color-form assignments clearly indicated that the association hypothesis was favored over Kandinsky's. This held regardless of experimental condition.

In addition, an analysis of the rationales that participants gave to account for their assignment choices showed that 51 (56%) of the 92 participants, who had chosen the red triangle, blue square, and yellow circle, mentioned *both* the traffic sign/warning triangle and the sun in their rationale. An even larger number of people used at least one of the two links. Thus, not only the distribution of assignments but also the underlying associations were supported in the present study. Interestingly, twice as many participants used this association rationale under the Mere-correspondence instruction ($n=34$) than the Aesthetic-correspondence instruction ($n=17$), although the absolute number of choices ($k=46$) was identical in both conditions [$\chi_1^2(N=200)=7.6$, $p<.006$]. This finding suggests that, when asked for an aesthetic assignment, participants were more reluctant to give the explanation based on the prosaic association for their choice than under the Mere-correspondence instruction, even though they likewise used this assignment.

Kandinsky postulated a fundamental relation between color and form. Consequently, on the second page of the booklet participants were asked whether they thought such a fundamental relation between the present colors and forms was possible. Sixty-two percent answered affirmatively, and 27% negatively. With regard to this pattern, there was no difference between the Mere-correspondence and the Aesthetic-correspondence conditions [$\chi_2^2(N=200)<1.00$]. Despite this result, three times as many participants considered their own assignment variable (66%) rather than fixed (22%). Of those who considered their assignment fixed, 64% selected the association assignment.

Part II

The frequencies and percentages of the six different assignments participants made in Part II under the Mere-correspondence and the Aesthetic-correspondence instruction are given in Table 1. The pattern of results closely resembled that of Part I. The association assignment (warning triangle and the sun) was the most frequent one under both instructions. Kandinsky's assignment was among the least frequently chosen ones. This also held under both instructions. The distributions of assignments were not significantly

different under the two instructions [$\chi_5^2(N=58)=4.09$, ns]. The distributions of assignments differed from the equal distribution under both instructions: Mere-correspondence instruction [$\chi_5^2(N=39)=35.3$, $p=.001$] and Aesthetic-correspondence instruction [$\chi_4^2(N=19)=22.8$, $p=.001$].

Of the participants 59% who chose the association assignment in Part II (19 out of 32) gave the warning triangle/sun rationale for their choice. Even more participants mentioned at least one of the two items in their account. In Part II, however, there was no effect of instruction condition on the frequency the association was given in the rationale [$\chi_1^2(N=58)<1.00$].

In Part II, 66% of the participants considered a fundamental relation between the present colors and forms possible. Twenty-nine percent did not. As in Part I, there was no difference between the two instruction conditions [$\chi_2^2(N=58)=1.5$]. Only 10 participants reported that they remembered their assignment of Part I; eight of them consistently produced the sign/sun combination at both times.

Comparison of Part I and Part II

For the group, the assignment distributions were temporally stable. For individuals, temporal stability was investigated via contingency measures (Cramer's V). The contingency of the assignments in Part I and those of Part II was $V=.52$, regardless of participants' own stability predictions. About half of the participants ($n=28$) of Part II ($N=58$) chose the association assignment in Part I. Only three of them made a different choice in Part II. Contingency was slightly higher for participants who predicted their assignments would be stable ($V=.62$) than for those who predicted their assignment would change ($V=.50$). Interestingly, none of the participants who were unsure about the temporal stability of their assignments changed their minds between Parts I and II ($V=1.0$; $n=7$). Note that participants had no way to expect a second test.

In Part I, 19 out of 58 participants used the association account in the rationale for their assignment choice; the rest did not. Only four out of 58 had changed their mind in Part II, two in each direction. Consequently, 19 participants gave the association account in Part II, as well. Contingency was high ($V=.84$).

Of the participants, 31% changed their response in Part II regarding the possibility of a fundamental relation of color and form. The contingency was $V=.37$. Even more participants (40%) changed their response with respect to the predicted stability of their own assignment; $V=.27$.

Generally, participants did not try out the felt-tip pens to see the actual colors, rather they relied on other cues, i.e., the colored caps of the pens and their knowledge and imagination of yellow, red, and blue. This suggests that participants used the colors according to their prototypical understand-

ing of the basic colors, rather than basing their assignment choices in this questionnaire on the particular color tokens provided by the experimenter.

Discussion

The present study indicated that today's nonartist university students have a clear group preference when asked to assign basic colors to basic forms. About half of them preferred a red triangle, a blue square, and a yellow circle. This assignment stood regardless of a variation of instruction and was temporally stable. World knowledge associations were stated very frequently in the rationale for an assignment choice. The red triangle resembles a traffic sign, a warning triangle, and the yellow circle resembles the sun. Kandinsky's assignment, however, was the least preferred one. Besides the group preference, the second half of the participants had considerable individual differences.

The assignment distributions did not differ under the Mere-correspondence and the Aesthetic-correspondence instructions. This suggests that both instructions probed the same underlying representations and processes. Their operation led to similar group responses regardless of instruction. There are two variants of this account. One version holds that participants spontaneously produced the most beautiful color-form assignments, even if they were not explicitly asked to do so under the Mere-correspondence instruction. A second possible account is that participants used what came to mind in order to master the task. That is, a common informational basis was employed by the participants under both instructions. In the present study, a high percentage of participants mentioned world-knowledge associations in the rationales they gave for their assignment choices. These associations very often were the warning triangle and the sun. Participants used this knowledge source, which is genuinely nonaesthetic, for the task regardless of instructional variation. Consequently, based on these considerations, it is more likely that a majority used nonaesthetic associations as an informational basis for both tasks rather than genuinely aesthetic information. Other strategies to simplify the task at hand were not prominent. For instance, a sequential assignment of lighter to darker colors from left to right of the questionnaire, or vice versa, occurred in only two cases. As predicted, assignments based on world knowledge associations, the association hypothesis in particular, were more temporally stable for individuals than others. Overall, the assignment pattern was very stable for the group.

World knowledge associations have different variability. Some might change historically or culturally, like a traffic sign. Others are rather constant, like the yellow sun. In addition, the sun can also appear in red color, close to sunset for instance. Hence, associations are not necessarily one to one, but can be ambiguous. A circle, for example, might resemble a yellow,

red, or blue flower, if filled correspondingly. Thus, an individual often has an eclectic informational basis for a choice. Consequently, the conditions of producing selective associations and the motivation to prefer subsequently one over the other lie at the heart of an interpretation. Naturally, these conditions and motifs are complex. For example, the yellow triangle as a symbol of God might be culturally omnipresent. Or, there might be a cultural fashion that sees the blue circle as resembling a blue flower and strongly favors it. During the age of European Romanticism, the color blue was a prevalent theme in combination with the concept of flower. The circle was regarded as the ideal form during this epoch. During this era there was also a strong leitmotif to experience synaesthetic links of different items. Since the days of European Romanticism the Zeitgeist has changed completely. Accordingly, the present study probably would have yielded completely different results during that time. Homogeneity of a group or society influences the response to some extent and, as a consequence, in addition to individual, group-specific, and societal leitmotifs, influences assignment preferences. The present results indicated no prevalent fashion for color-form correspondence. Agreement or homogeneity was limited to half of the individuals. And here, everyday world knowledge associations were employed, not assignments prescribed to a correspondence rule.

Expert-novice differences are of particular interest in color-form correspondence. A specific artistic training might lead to a different and more homogeneous choice of assignments, if it was exclusively based on Kandinsky's correspondence theory than on a number of inconsistent tutorials. On the contrary, the claim that Kandinsky's assignment validly reflects a universal color-form correspondence, however, has been traditionally held (cf. Droste, 1990). Consequently, a universal correspondence should equally hold for experts and laymen. Lupton and Miller (1993/1994) reported results by a small number of contemporary designers who have filled out Kandinsky's questionnaire in 1990. Six out of eight participants produced assignments different from Kandinsky's. Two produced his original assignment but gave different explanations. Although the empirical data are still scarce, it can be stated that contemporary design experts, on the majority, do not advocate a universal correspondence of basic colors and forms.[4] Taking these facts and the results of the present study together, color-form assignment preferences appear to be influenced more or less strongly by education and experience.

[4]In the winter semester 2000/01, Dr. Christian Wolsdorff of the Bauhaus Archiv, Berlin, asked 30 second- and third-year college students of color design (Studiengang Farbgestaltung) of the Fachhochschule Hildesheim to fill in Kandinsky's questionnaire. Ninety-seven percent of these experts produced Kandinsky's assignment. All of them reported that their choice reflected the historical facts, not their personal preference nor contemporary professional usage (C. Wolsdorff, personal communication, April 27, 2001).

Consequently, they are culturally dependent. Further, they may be dependent on subculturally prevalent conditions, like the spirit of the Bauhaus in this case.

In sum, a framework of factors influencing color-form assignments can be assumed, reflecting cultural and subcultural relativity. It consists of historical and cultural change, individual education and experience, fashion, and the presence and strength of individual, group-specific, and societal motifs. It is argued that the contemporary peculiarity of these factors led to the present results.

Based on the present data and the above framework, one can speculate about the historical data. For Kandinsky and others as well, e.g., Itten (cf. Poling, 1982/1986), the quest for fundamental color-form correspondence was only natural. This might have been partly rooted in his education and in his professional field. One other likely candidate to explain this striving, particularly in Kandinsky's case, was synaesthesia. A synaesthetic sensation of color and form could be a strong motif to search for fundamental color-form correspondence and a universal grammar of a visual language. The participants of the 1923 survey were, most likely, experts in the fine arts and design. Leaving aside all the methodological problems with the original study, including the fact that Kandinsky's students might have considered the questionnaire a test, this difference to the present study remains. The Bauhaus students formed a comparably homogeneous group of avant garde, elite artists. They were probably more motivated to look for color-form correspondence and do this in the spirit of the Bauhaus than a contemporary group of nonartistic students. Also, most likely Bauhaus students were prompted to contemplate about color-form correspondence by the courses they took, whereas the present participants were asked to produce color-form assignments, which is a quite specific task that does not occur often in everyday life. These differences, however, should be irrelevant with respect to assignment choices if there was a universal correspondence.

Undoubtedly, there has been a cornucopia of changes since the days of the 1923 survey. For instance, while traffic and warning signs are set in primary colors, internationally standardized, and omnipresent today, neither was the case in 1923. The use of color in general has changed dramatically. In addition to numerous other cultural changes, this provided a different background for learning for today's nonexpert students. Given the above framework of influences, the present results are very likely to differ from Kandinsky's original account due to these former changes. Fundamental correspondence of basic colors and forms was not found. In fact, color-form correspondence is conditioned by cultural relativity.

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APPENDIX

FREQUENCY OF ONE-TO-ONE ASSIGNMENTS OF BASIC COLORS YELLOW, RED, AND BLUE TO BASIC FORMS OF TRIANGLE, SQUARE, AND CIRCLE: REPLICATION OF AESTHETIC-CORRESPONDENCE INSTRUCTION ($N = 85$)

Replication	Assignment					
	yrb Δ □ O	ybr Δ □ O	ryb Δ □ O	rby Δ □ O	byr Δ □ O	bry Δ □ O
Frequency	9	19	10	30	8	9
Percent	11	22	12	35	9	11

Note.—y = yellow, r = red, and b = blue; Δ = triangle, □ = square, and O = circle. Eighty-five students (12 men, median age 20 yr., range 18 to 60) of an introductory psychology class at the University of Leipzig were tested in a group session in a lecture hall under uniform artificial lighting conditions. Nine randomly arranged odd-shaped color patches (yellow, red, and blue, three patches, respectively) were presented via an overhead projector.