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TRAINING IN ART AS A FACTOR IN THE DETERMINATION OF PREFERENCE JUDGEMENTS FOR POLYGONS

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Ninety polygons were rated for their aesthetic value by 369 male and 408 female art students, and by 176 male and 180 female non-art students. Factor analyses of the resulting rankings were carried out for the art and non-art groups separately, and the resulting factors and superfactors compared. Most of the factors were similar for the two groups. Artists preferred simple polygons, non-artists complex ones. For the majority of polygons preferences were rather similar; removing the most extreme 16 simple and 16 complex items produces a correlation between mean artist and non-artist judgements of 0·92. Birkhoff's formula has little predictive value, although it correlates slightly better with the artists' than with the non-artists' rankings. Artists were higher on neuroticism than non-artists, but did not differ from them on extraversion.

Fechner (1897) originally suggested that the empirical study of preferences for polygonal figures could aid materially in the development of experimental aesthetics, and indeed put forward a number of hypotheses which he unfortunately never put to the test. Birkhoff (1932) advanced some alternative hypotheses, in particular the notion that an aesthetic measure (M) could be derived for polygons (and indeed for all other types of artistic material) in such a way that order elements (O) contributed positively and complexity elements (C) negatively; he thus arrived at a formula $M = O/C$. He further contributed to the development of the field by publishing a set of 90 polygons, and by defining very carefully and objectively the O and C elements to be used in relation to these figures. He did not carry out any research into the actual preference judgements of people, and such empirical work as has been done with his formula (Eysenck, 1941*a*) suggests that it does not in fact correlate with the mean preference judgements of divergent groups of subjects. Eysenck (1941*a*, 1968) has suggested a different formula, which is much closer to Fechner's original suggestion, viz. $M = O \times C$, and has shown that this formula is more in line with empirical preference judgements.

Birkhoff could argue that his formula might not apply to the non-artistically trained subjects of these experiments, but that people who had received such training would demonstrate higher correlations with it. While he does not specify any such restrictions on the use of his concepts, it is by no means improbable that artists and controls will not agree completely, or may in fact disagree, in their preference judgements. It is also possible that men and women disagree; there has been little research done on sex differences in this field. And lastly, and most importantly, it seems possible and indeed likely that personality differences will predispose individuals to prefer different types of polygons; Eysenck (1941*b*) has provided some evidence for this notion, although in a somewhat different context.

The aim of the research reported here, then, is to study in detail the factors which determine the preference judgements of artists and controls, men and women, extraverts and introverts, toward the 90 polygons assembled by Birkhoff. A number of predictions were made, but without too much confidence; in so far as these were based on previous studies or published theories, they will be referred to in our discussion. In the main the research was designed to collect facts rather than to confirm theories; too little work has been done in this field to make prediction easy. The present paper will not deal with the sex and personality differences found; these will be discussed in a subsequent publication.

METHOD

The 90 polygons published by Birkhoff were individually photographed and prepared as slides; these slides (black on white, rather than blue on white, as in Birkhoff's book) were shown seriatim to the subjects of the experiment in groups varying in size from small to medium. Instructions were to rate each polygon for aesthetic pleasingness on a 7-point scale, from 7, the most pleasing, down to 1, the least pleasing. Subjects found this task relatively easy, although the more artistic ones questioned the whole notion of testing and measurement in this field. Subjects were also administered the Eysenck Personality Inventory, Form A, and scores for extraversion (E), neuroticism (N), and a lie scale (L) obtained.

Subjects taking part were divided into artists and controls on the basis of whether or not they had received formal training in the visual arts; these two groups were subdivided into males and females. There were 369 male artists and 408 female ones; there were 176 male controls and 180 female ones. The use of the term 'artists' in this connexion may be made more precise by listing the types of courses which those grouped under this name had attended, or were attending. These courses included graphic design, fashion design, fine arts (painting and sculpture), architectural studies, typographic design, textile design, cinematography, photography, industrial design, theatre design, interior design, stained glass and ceramic design, silver and jewellery design; included also were some postgraduate students and some professional artists. By contrast, the controls included students of surveying, law, commerce, accounting, hairdressing, electrical engineering, mechanical engineering, secretarial students, hotel work and catering students, student linguists, gas-fitting apprentices and day release (retail trade) students. Ages of both groups ranged from 16 to 25, with a few above the latter age; the great majority were around 20 yr. old.

The groups differed with respect to personality, in that the artists were markedly higher on N than were the controls; this is true of both men (12·16 *v.* 10·05) and women (13·79 *v.* 11·96). For E, artists were if anything below the control values, but not very much; this again is true of men (12·29 *v.* 13·45) as well as women (12·42 *v.* 12·94). Values on the lie scale did not show any trend at all, and the mean value is near 2·5 for all groups. In view of the fact that comparisons involving personality and sex will be carried out separately within the two groups, these differences are not of any great importance; they do demonstrate again the well-known fact that women are higher on N, but fail to support the equally well-established fact that they also tend to be lower on E. (Control women are in fact lower on E, but artist women are not.)

RESULTS AND DISCUSSION

In order to make a proper comparison of the bases for preference judgements between artists and controls, the ratings were subjected to factor analysis; principal components methods were used to extract 90 factors, and the 12 factors having the highest latent roots were then subjected to rotation. This number was decided upon on the basis of a previous analysis (Eysenck, 1968), although 18 and 21 factors respectively had eigenvalues above unity in the two groups. Experience has shown that most of these factors are just doublets, often difficult or even impossible to interpret, and it will be seen that even our choice of 12 factors may have erred on the side of generosity. Rotation was accomplished by the Promax method (Hendrickson & White, 1964), which gives oblique factors and extracts higher-order factors; the same method had been used with advantage in the previous study.

There is one difference between the present study and the previous one, in which 160 industrial apprentices had ranked the polygons according to a prearranged scheme, which is important and should be mentioned explicitly here. Ranking eliminates individual (and group) differences in the level of appreciation; when polygons are rated two individuals might produce the same relative ordering of the polygons, but do so at different levels—one might dislike all polygons, and have a mean score of 3, while the other might like all polygons, and have a mean score of 5. These differences in level produce a general factor (third-order factor) which is absent from an analysis of rankings, and which is for all intents and purposes a statistical artifact. Ranking has thus a statistical advantage, but of course it makes impossible group administration of the test, and also induces boredom; furthermore, with as many as 90 stimuli ranking becomes very difficult to do. For these reasons we decided to employ a rating procedure instead in the present experiment.

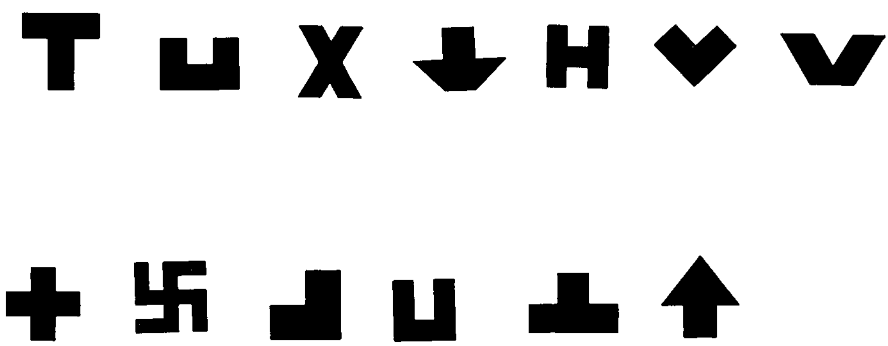

Fig. 1. Factor A: rectangularity.

Factor A is very similar for both A and C groups, with a coefficient of factor similarity of 0·82 (Barlow & Burt, 1954). All factor loadings above 0·3 are listed in Table 1; given in brackets are the item numbers. Items are listed in order of size of loading. (These conventions will be observed in all later listings.) Fig. 1 shows the polygons having sizable loadings on both the A and C group factors (the first seven polygons) followed by two polygons having high loadings for the C group, but failing to exceed the arbitrary 0·3 limit for the A group, and four polygons having high loadings for the A group, but failing to exceed the 0·3 limit for the C group. This factor resembles closely one end of the third-order factor in the original Eysenck study (see Eysenck, 1968, Fig. 5); the tentative interpretation then given of the factor was that it opposed simplicity (right angles, parallel lines) to complexity (oblique angles, non-parallel lines). It is impossible to maintain this interpretation for our factor A in view of the fact that polygons 1–4 are not included in this factor; these are all extremely simple, and will be found to constitute a separate factor in our analysis. The best label for our factor might be 'rectangular', although like all factor names suggested in this paper this term is put forward very tentatively. The third-order factor in the previous analysis clearly combines this 'rectangular' factor with our 'simplicity' factor which will be discussed later on. The correlations between these two factors in our analysis are in fact both positive, amounting to 0·30 for the A group, and 0·27 for the C group. This lends support to our interpretation.

Table 2 lists the loadings for factor B, labelled 'simplicity' for the present; the coefficient of factor similarity is 0·85. Fig. 2 shows the seven polygons having high loadings on factors for both groups. There is not likely to be much argument about

Table 1. *Factor A*

Artists	Controls
0·80 (42)	0·72 (42)
0·76 (44)	0·63 (39)
0·70 (55)	0·59 (43)
0·69 (62)	0·59 (44)
0·63 (59)	0·56 (23)
0·62 (23)	0·51 (36)
0·59 (39)	0·45 (59)
0·56 (26)	0·39 (9)
0·56 (56)	0·31 (41)
0·56 (43)	
0·47 (36)	
0·42 (54)	
0·42 (85)	
0·41 (29)	
0·38 (58)	
0·36 (45)	
0·35 (57)	
0·35 (66)	
0·33 (65)	
0·33 (78)	
−0·33 (4)	
0·32 (49)	
0·31 (41)	

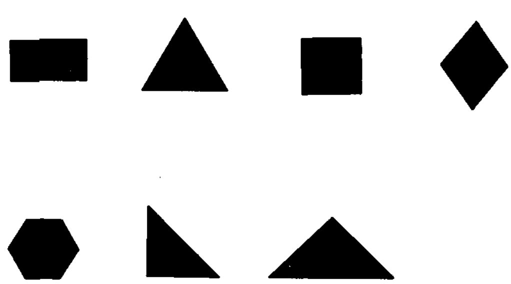

Fig. 2. Factor B: simplicity.

Table 2. *Factor B*

Artists	Controls	Artists	Controls
0·74 (3)	0·88 (2)	0·54 (4)	0·52 (11)
0·73 (2)	0·85 (1)	0·52 (11)	0·44 (70)
0·72 (1)	0·67 (3)	0·47 (5)	0·32 (5)
0·58 (70)	0·62 (4)	0·33 (12)	−0·32 (77)
			0·31 (63)

the nature of this factor; square, rectangle, diamond, triangle, are among the simplest and most familiar figures in the whole set, and of course the fact that numbers 1–5 are included in this set means that the five polygons having the highest Birkhoff scores for 'order' are part of the set. This factor is very similar to factor 3 in the original Eysenck study.

Factor C appears to represent polygons having rotational symmetry as their outstanding characteristic; artists and controls have an index of factor similarity of 0·87, and the factor closely resembles factor 6 of the original Eysenck study. Table 3 and Fig. 3 document this identification.

It is interesting that for both groups items 45, 85 and 74 (i.e. the last three polygons in Fig. 3) appeared as a separate factor (factor 7) in the original analysis. They do have rotational symmetry, as defined by Birkhoff, and hence fit into our interpretation of the factor; at the same time they seem to represent variations on a common

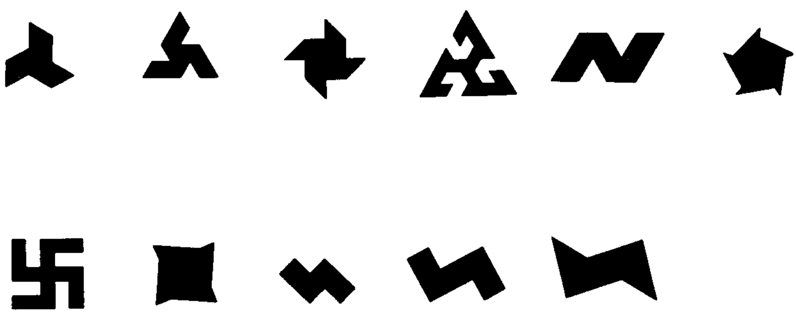

Fig. 3. Factor C: rotational symmetry.

Table 3. *Factor C*

Artists	Controls	Artists	Controls
0·79 (69)	0·69 (89)	0·44 (41)	0·53 (84)
0·71 (89)	0·61 (45)	0·43 (45)	0·48 (51)
0·67 (53)	0·61 (53)	0·41 (67)	0·37 (65)
0·65 (51)	0·60 (69)	0·41 (85)	0·34 (74)
0·57 (65)	0·60 (85)	0·35 (84)	0·31 (37)
0·50 (88)	0·55 (88)	0·32 (74)	0·30 (41)

theme (called the S-curve theme in the original paper) which sets them slightly apart from the other polygons. (Number 65 also belongs in this group.) Rotational symmetry may be achieved by rotation through 180° for these three polygons, while for the others the angle involved is either 90° or 120°; it seems likely that the factor would break up into three subfactors if a larger number of factors had been extracted.

It is not sufficient to say that the polygons characteristic of this factor have rotational symmetry; so have the square, the equilateral triangle, and many others which do not appear to have high loadings on factor C. The polygons included here not only have rotational symmetry as defined by Birkhoff, they actually *suggest* rotation, rather in the manner of a Catherine wheel. By contrast, the square and the equilateral triangle are essentially immovable, firmly set on their bases, and not suggestive of rotary movement. The Gestalt-like quality in question is obvious to the glance, but difficult to describe; nevertheless it apparently has served as a principle of preference judgements in our group.

Factor D is documented in Table 4 and Fig. 4; the index of factor similarity is 0·82. This factor compares with factor 1 in the original Eysenck article; it was then said that 'characteristic of this factor seems to be an elongated projection or protuberance, somewhat like a steeple'. This description still seems to fit most of the polygons included here.

Factor E is similar for artists and controls, with an index of factor similarity of 0·86. It seems to combine two of the original Eysenck factors, viz. factors 2 and 4. Items from these two factors resemble respectively circles and ellipses whose curves had been changed to straight lines; an alternative way of describing them would be to say they resemble squares and oblongs with corners cut off to make them approach

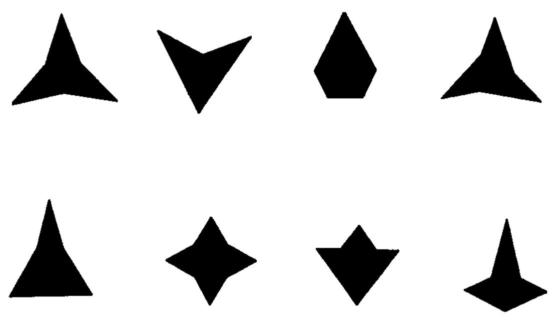

Fig. 4. Factor D: projections.

Table 4. *Factor D*

Artists	Controls	Artists	Controls
0·74 (27)	0·68 (90)	0·52 (31)	0·40 (28)
0·74 (46)	0·61 (27)	0·51 (52)	0·37 (52)
0·63 (28)	0·58 (75)	0·50 (75)	0·30 (74)
0·59 (17)	0·53 (46)	0·31 (73)	0·30 (20)
0·55 (90)	0·51 (71)	0·31 (40)	−0·30 (12)
0·52 (71)	0·45 (31)	0·30 (35)	

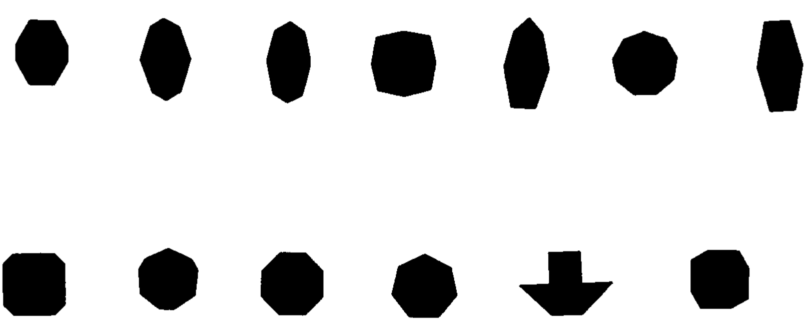

Fig. 5. Factor E: elliptical.

the shape of a circle or an ellipse. In any case the details regarding this factor are given in Table 5 and Fig. 5; it seems likely that had more factors been extracted, this factor would have split into two, as in the previous research.

Factor F presents some complications because it appears as one factor in the controls, but as two in the artists. Table 6 sets out the two artists factors, as well as the single controls factor. Fig. 6 sets out the two sets of polygons, first those in common between the controls factor and the first of the artist factors, second those in common between the controls factor and the second of the artist factors. The respective indices of factor comparison are 0·71 and 0·75, and the first factor is similar to factor 5 in the original Eysenck study (elaborate cross designs), while the second factor (star patterns) was not found in the other study. It might be asked how

Table 5. *Factor E*

Artists	Controls	Artists	Controls
0·78 (33)	0·71 (21)	0·56 (22)	0·52 (60)
0·74 (32)	0·67 (30)	0·44 (30)	0·49 (22)
0·72 (63)	0·66 (33)	0·41 (12)	0·48 (12)
0·67 (21)	0·64 (32)	0·38 (10)	0·48 (20)
0·60 (60)	0·62 (16)	0·38 (47)	0·42 (63)
0·56 (16)	0·59 (10)	0·32 (48)	0·34 (47)
0·56 (20)	0·57 (48)		0·31 (79)

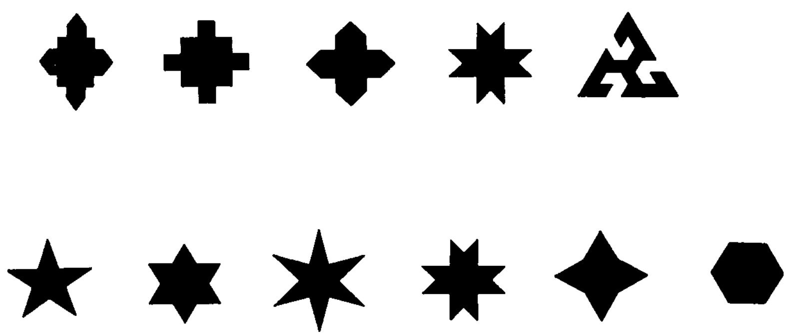

Fig. 6. Factor F: star and cross.

Table 6. *Factor F*

Artists: F_C	Artists: F_S	Controls
0·75 (50)	0·72 (8)	0·82 (24)
0·68 (25)	0·69 (6)	0·72 (40)
0·52 (13)	0·60 (40)	0·72 (50)
0·52 (87)	0·58 (24)	0·71 (6)
0·50 (24)	0·53 (31)	0·65 (25)
0·46 (80)	0·36 (5)	0·62 (8)
0·41 (82)	0·32 (9)	0·62 (13)
0·37 (29)	0·31 (39)	0·40 (51)
0·33 (68)		0·36 (31)
0·32 (51)		0·35 (29)
0·31 (22)		−0·32 (79)
		0·31 (88)
		0·31 (5)
		0·31 (4)

it is possible for two such apparently dissimilar types of design to be amalgamated into one factor. The answer would appear to be that some figures are intermediate between these two pure designs, e.g. 24 and 31. One might have expected the artists to have a finer sense of discrimination here, and it is they of course who in fact separate out these two bases of judgement into two factors.

We have now exhausted the large, massive, easily interpretable factors on which both artists and controls agree to a reasonable extent; we must turn to the smaller, less obvious factors on which there is little or no agreement between the groups. For

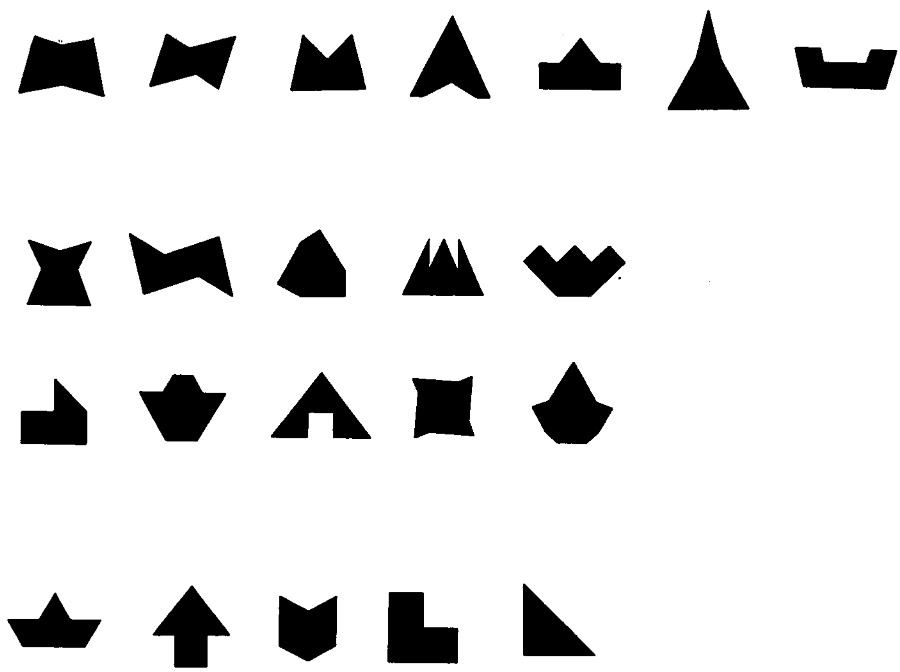

Fig. 7. Factor G: distortion.

Table 6. *Factor G*

Artists	Controls
0·72 (76)	0·82 (57)
0·69 (77)	0·71 (58)
0·67 (81)	0·69 (56)
0·63 (72)	0·61 (54)
0·56 (73)	0·60 (72)
0·49 (74)	0·47 (73)
0·49 (79)	0·46 (77)
0·48 (82)	0·45 (55)
0·45 (68)	0·45 (71)
0·44 (78)	0·43 (76)
0·43 (61)	0·42 (70)
0·38 (58)	0·32 (83)
0·36 (80)	
0·35 (84)	
0·35 (86)	
0·35 (71)	
0·33 (83)	

the most part there is not much help to be derived from the earlier Eysenck study either, as these new factors have no obvious match. This inevitably means that their interpretation is more haphazard and subjective, and should be treated with even more caution than usual. With these thoughts in mind, we turn to factor G, documented in Table 7 and Fig. 7. The index of factor similarity is only 0·55, which suggests that while these two factors are not entirely dissimilar, yet they can hardly be considered identical. Fig. 7 shows polygons loading high for both groups, polygons loading high in the artist group, and polygons loading high in the control group. There is a slight similarity with factor 8 of the original Eysenck study, which was then found impossible to interpret. Clearly interpretation is very hazardous, but taking courage into both hands we might perhaps suggest that many of the polygons in common to the two groups seem to be pinched-in, or distorted, or oblique transformations of simple, ordinary shapes, like rectangles. In some cases, embellishments seem to have been added to simple shapes, as, for instance, 58, where a small triangle has been added to a rectangle. We might perhaps suggest that this factor was concerned with the notion, rather difficult to pin down, of systematic change of simple forms in some sort of regular manner. If this sounds indefinite, then so does the factor seem indefinite, and perhaps it is unwise to attempt an interpretation at all.

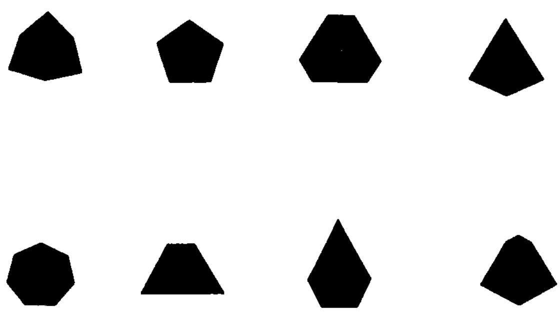

Fig. 8. Factor H: variants of a triangle.

Table 8. *Factor H*

Artists	Controls	Artists	Controls
0·67 (14)	0·70 (17)	−0·35 (22)	−0·35 (39)
0·67 (7)	0·65 (18)	0·32 (30)	0·34 (7)
0·66 (15)	0·53 (15)	0·30 (17)	−0·30 (23)
0·49 (10)	0·48 (14)	0·30 (5)	
0·38 (35)	0·40 (28)		

Factor H is documented in Fig. 8 and Table 8; the index of factor comparison is only 0·51, which suggests that the two groups only agree marginally on the precise nature of this factor in forming a principle of preference judgement. The factor has similarities to factor 12 in the original Eysenck study, where it was identified as 'variants of a triangle'; this description is not very clear, and may miss the essential nature of this factor altogether. Because only the first four polygons in Fig. 8 are in common to artists and controls, four further polygons having above 0·30 loadings for only one group have been added (10, 18, 28, 35) to make interpretation easier. In the absence of anything better, we will retain the epithet 'triangular' to describe this factor, but with a distinct feeling that a better term will in due course be suggested.

Factor I presents some difficulties because indices of factor identification suggest that there are two factors among the artists showing similarity with one factor among the controls. Table 9 and Fig. 9 document the details of this comparison. The upper row in Fig. 9 shows the polygons in common between the controls and one of the artist factors, while the lower row shows the polygons in common between the controls and the other of the artist factors; polygon 64 has been added to the second row because it almost tops the second artist factor and does not fall far short of the arbitrary value of 0·3 for the controls. Both factors appeared in the original Eysenck study (factors 9 and 13); the interpretation of the former was felt to be difficult, but was thought to 'suggest a three-dimensional structure and recall such well-known figures as the Necker cube'. The interpretation of the latter factor was that 'this

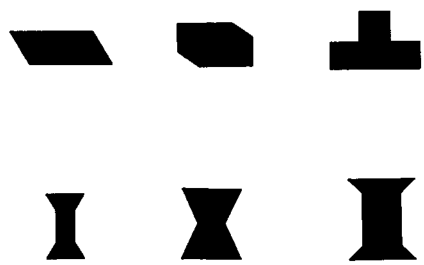

Fig. 9. Factor I: three-dimensional figures.

Table 9. *Factor I*

Artists	Artists	Controls
0·57 (19)	0·66 (38)	0·64 (34)
0·48 (37)	0·60 (64)	0·61 (38)
0·43 (22)	0·56 (34)	0·51 (37)
0·40 (18)	0·43 (20)	0·43 (19)
0·39 (26)	−0·32 (79)	0·38 (29)
−0·31 (56)		0·37 (25)
0·31 (74)		0·35 (36)
		0·34 (31)
		0·30 (26)

factor may perhaps be called a "pillar" factor', although again no great confidence was felt in the accuracy of the interpretation. Nor is it clear why these two factors should have melted into one for the controls; possibly the 'pillars' of the one factor suggest a three-dimensional solidity to some viewers. It would serve no purpose to pursue such speculations at this time.

The remaining artist factor is rather meaningless, and defies interpretation (but see below). This leaves two factors for the controls, J and K; the former is documented below in Fig. 10 and Table 10. Factor J bears some similarity to two factors in the original Eysenck study, factors 10 and 8, both of which were found difficult to interpret. The only suggestion which seems to fit most of the polygons having high loadings would seem to be that this factor represents solid, regular figures from which bits have been cut out, or into which nicks or niches have been introduced. Consider polygons 82, 80, 83 and 81, shown in Fig. 10; these illustrate our meaning. It should, however, be added in fairness that not all polygons with high loadings are as clear-cut examples of our interpretation: 67, 78 and 65 would be difficult to fit into this explanation. Factor K has no similarity to any of the original Eysenck factors, and does not suggest any obvious interpretation; loadings on it are given in Table 11 for the sake of completeness. Like the last of the artist factors it may be regarded for the time being as a statistical artifact. This last artist factor has some affinity to part of factor G of the controls; it has high loadings on items 43, 56, 57, 58 and 61. There is vague similarity to arrowheads in these polygons, but interpretation is really not possible. We will refer to this factor as L.

Fig. 10. Factor J: solid figures with nicks.

Table 10. *Factor J*

Controls	Controls
0·59 (66)	0·34 (59)
0·58 (67)	−0·33 (54)
0·48 (82)	0·32 (62)
0·47 (80)	0·32 (74)
0·43 (65)	0·32 (78)
0·38 (81)	0·30 (83)
0·38 (64)	

Table 11. *Factor K*

Controls	Controls
0·60 (86)	0·44 (68)
0·50 (61)	0·38 (52)
0·49 (87)	0·37 (47)
−0·46 (19)	

The primary factors discussed above are of course oblique, rather than orthogonal, and the correlations between them give rise to second-order or superfactors; four of these were extracted for each of the two groups of subjects. Superfactor 1 is documented in Table 12; loadings below 0·5 are not given as there is a very large number of 0·4 and 0·3 loadings, and these would not aid the identification very much. This factor combines primary factors D, E, G and H; the index of factor similarity is 0·88 between artists and controls. Interpretation is not entirely easy, but something of the nature of the factor seems to be captured in the phrase 'modification of simple, solid figures'. These modifications may consist in cutting off the corners, adding pointed projections, pinching out nicks and niches, etc.

Superfactor 2 is composed of primary factors A and B; here the coefficient of factor similarity is 0·86, and the details are given in Table 13. Loadings below 0·4 are not given for the artists, nor below 0·5 for the controls, for reasons already stated. This factor resembles the 'simplicity' factor (third-order factor) extracted by Eysenck in his original study. There is little interpretation required here; the loadings speak for themselves.

Superfactor 3 is composed of primary factors C and F; the coefficient of factor similarity is 0·84, and the details are given in Table 14. Loadings are not given below

0·5 for artists, nor below 0·4 for controls. This factor thus combines star shapes, crosses and rotational symmetry polygons in a relatively meaningful set. Altogether these three superfactors 'make sense' in a rather subjective way; the remaining two superfactors, one for each group, do not, and neither are they identical from group to group. As they only contain a very few high loadings they will not be discussed further.

Table 12. *Superfactor 1*

Artists	Controls
0·72 (14)	0·67 (15)
0·70 (15)	0·66 (60)
0·67 (30)	0·61 (32)
0·66 (79)	0·58 (14)
0·64 (32)	0·57 (28)
0·63 (60)	0·56 (20)
0·61 (35)	0·55 (86)
0·60 (48)	0·55 (79)
0·60 (21)	0·54 (35)
0·56 (33)	0·52 (17)
0·55 (10)	0·52 (47)
0·54 (86)	
0·54 (76)	
0·54 (47)	
0·52 (61)	
0·51 (28)	

Table 13. *Superfactor 2*

Artists	Controls	Artists	Controls
0·68 (55)	0·68 (1)	0·47 (26)	0·53 (62)
0·55 (44)	0·66 (55)	0·46 (22)	0·52 (26)
0·54 (54)	0·63 (44)	0·46 (85)	0·52 (42)
0·53 (62)	0·63 (11)	0·43 (45)	0·50 (64)
0·53 (70)	0·59 (70)	0·42 (12)	
0·50 (42)	0·56 (2)	0·40 (78)	
0·48 (2)	0·54 (56)		

Table 14. *Superfactor 3*

Artists	Controls	Artists	Controls
0·64 (67)	0·72 (40)	0·54 (51)	0·52 (13)
0·62 (40)	0·70 (24)	0·54 (69)	0·47 (25)
0·61 (24)	0·64 (8)	0·54 (89)	0·46 (27)
0·59 (88)	0·60 (50)	0·52 (41)	0·46 (53)
0·56 (8)	0·57 (5)	0·52 (90)	0·46 (82)
0·56 (65)	0·56 (51)	0·51 (39)	0·43 (49)
			0·43 (69)

It is of course possible to extract a third-order factor from the intercorrelations of the four superfactors; this third-order factor is very similar for the two groups, having an index of factor comparison of 0·97. It has no rational interpretation in terms of the polygons involved, but is, in essence, identical with the first unrotated principal components factor. In a positive manifold, high loadings on the first principal component simply mean that the tests or items having these loadings correlate most highly with all the other items; conversely, tests or items having low loadings correlate least with all the other items. The factor originates from the different levels of average ratings produced by the subjects; it can be eliminated completely by substituting rankings for ratings, i.e. by having a singly centred matrix, as in the original Eysenck study, where no such factor was found. Because of its lack of psychological interest no further discussion is given of this factor, which from the point of view of our discussion is no more than a statistical artifact.

Having discussed the factors emerging from our analysis, we must next turn to the ratings of individual polygons by our two groups. Table 15 gives in the first two columns the means for artists and controls, and in the next two columns the S.D.s for artists and controls, of the 90 polygons; the artists like the polygons slightly less well than the controls (respective means are 3·78 as against 3·92), but this difference is very slight. Artists do not agree among themselves quite as much as do controls (mean S.D.s are 1·57 as against 1·43), but again the difference is slight. The correlation between artists and controls is 0·67, which suggests that they have slightly less than 50 per cent in common as far as the causes for their preferences are concerned. In the original Eysenck study apprentices who constituted the sample were rather like the controls in this study, and it is not impossible to correlate their mean preference judgements against those of our two groups, with the expectation, of course, that they would be more like the controls than the artists. The correlations bear this out; with the controls the correlation is 0·86, with the artists 0·47. It is also possible to correlate Birkhoff's aesthetic measure (M) against the preference judgements of the artists and controls; previous work suggests low relationships (Eysenck, 1941*a*). Correlations are 0·28 for the artists and 0·04 for the controls; as M emphasizes the order elements it would seem that artists value these slightly higher than do the controls. In a similar way Eysenck's (1968) simplicity factor, i.e. the third-order factor extracted from the intercorrelations between the 90 polygons, may be correlated with the preference judgements of artists and controls; the values are very similar to those obtained for M (0·28 and 0·07), again suggesting that artists value simplicity more highly than do controls.

The mean ratings for the polygons can be divided into two sets: set A is constituted of those polygons which show marked differences between artists and controls, and set B, on which they show marked agreement. The point at which the division is made is of course somewhat subjective; how large a difference is large? Arbitrarily we have taken 32 items to make up set A, viz, the 16 items on which artists' preferences showed the largest positive differences from the controls, and the 16 items on which they showed the largest negative differences. Fig. 11 shows the former items, Fig. 12 the latter. (Set B is then constituted of the remainder of the items.) It will be quite obvious that artists prefer simple, orderly polygons, as compared with controls; controls prefer the complex type of polygon. For this set of items the correlation between artists and controls sinks to 0·29, while that between controls and apprentices rises to 0·90. (Artists and apprentices show a correlation of 0·12.) The items in set B show a correlation between artists and controls of 0·92; apprentices correlate 0·71 with artists and 0·82 with controls. To round off the list of intercorrelations, it may be added that the S.D.s of the 90 polygons ratings are very similar from one group to the other, r being 0·78.

A closer look at the actual ratings given by artists and controls to the 16 simple

Table 15

Variable	M_A	M_C	S.D.$_A$	S.D.$_C$
1	4·7	3·2	1·74	1·54
2	4·3	3·3	1·45	1·43
3	4·5	3·7	1·53	1·37
4	4·1	4·4	1·43	1·17
5	4·4	4·4	1·42	1·26
6	4·5	5·2	1·70	1·45
7	3·5	3·5	1·54	1·45
8	4·2	5·0	1·67	1·45
9	4·2	4·1	1·65	1·50
10	3·6	3·8	1·77	1·66
11	3·6	3·2	1·45	1·35
12	4·1	3·9	1·41	1·24
13	4·2	4·9	1·68	1·51
14	3·5	3·9	1·73	1·76
15	3·4	3·6	1·66	1·70
16	3·9	4·0	1·55	1·38
17	4·1	4·4	1·51	1·43
18	3·3	3·4	1·37	1·27
19	3·8	3·7	1·57	1·42
20	4·0	4·3	1·66	1·61
21	3·5	3·4	1·70	1·56
22	3·6	3·8	1·52	1·38
23	4·0	3·7	1·72	1·52
24	4·2	5·3	1·78	1·57
25	4·0	4·9	1·72	1·56
26	3·3	3·2	1·48	1·22
27	4·4	5·0	1·78	1·42
28	3·8	4·6	1·60	1·40
29	3·9	4·2	1·66	1·57
30	2·6	2·7	1·54	1·37
31	3·5	4·2	1·45	1·36
32	3·4	3·8	1·56	1·45
33	3·4	3·5	1·38	1·25
34	3·4	3·7	1·57	1·47
35	3·5	3·8	1·65	1·50
36	4·0	3·6	1·62	1·56
37	4·0	3·7	1·64	1·64
38	3·5	4·0	1·56	1·48
39	3·9	4·0	1·69	1·62
40	4·2	5·5	1·83	1·55
41	5·1	4·3	1·85	1·96
42	3·6	3·0	1·57	1·43
43	3·4	3·5	1·50	1·35
44	3·8	3·0	1·60	1·33
45	4·5	4·1	1·56	1·42
46	4·2	4·6	1·58	1·35
47	3·5	3·8	1·53	1·40
48	2·8	2·6	1·62	1·45
49	3·9	4·2	1·65	1·50
50	4·0	5·1	1·84	1·62
51	5·4	5·8	1·74	1·50
52	3·5	3·9	1·42	1·24
53	5·0	5·1	1·51	1·28
54	3·9	3·4	1·47	1·30
55	3·4	2·6	1·48	1·23
56	3·9	3·5	1·54	1·33
57	3·1	3·6	1·35	1·34
58	2·9	3·3	1·26	1·23
59	3·7	3·6	1·58	1·32
60	3·0	3·5	1·61	1·65

Table 15. (*cont.*)

Variable	M_A	M_C	S.D.$_A$	S.D.$_C$
61	2·8	3·2	1·30	1·25
62	3·7	3·0	1·52	1·24
63	3·4	3·3	1·46	1·36
64	3·0	3·6	1·47	1·28
65	4·5	4·5	1·57	1·36
66	3·7	4·0	1·59	1·43
67	3·9	4·0	1·65	1·56
68	3·3	3·9	1·48	1·35
69	5·1	5·2	1·56	1·38
70	4·1	3·4	1·54	1·56
71	3·8	4·2	1·68	1·46
72	3·1	3·1	1·35	1·19
73	3·4	3·7	1·45	1·36
74	3·9	4·1	1·63	1·45
75	4·1	5·0	1·71	1·34
76	3·0	3·2	1·38	1·36
77	3·4	3·5	1·48	1·36
78	3·2	3·0	1·45	1·30
79	3·0	2·8	1·73	1·64
80	3·5	3·9	1·54	1·48
81	2·9	3·6	1·37	1·39
82	3·4	4·5	1·62	1·49
83	3·3	3·3	1·39	1·31
84	3·9	3·7	1·62	1·55
85	4·2	3·6	1·41	1·36
86	3·1	4·0	1·55	1·53
87	3·6	4·4	1·56	1·38
88	4·4	5·1	1·59	1·41
89	4·9	4·8	1·53	1·39
90	4·1	4·6	1·81	1·64
Mean	3·78	3·92	1·57	1·43
S.D.	0·56	0·70	0·13	0·14

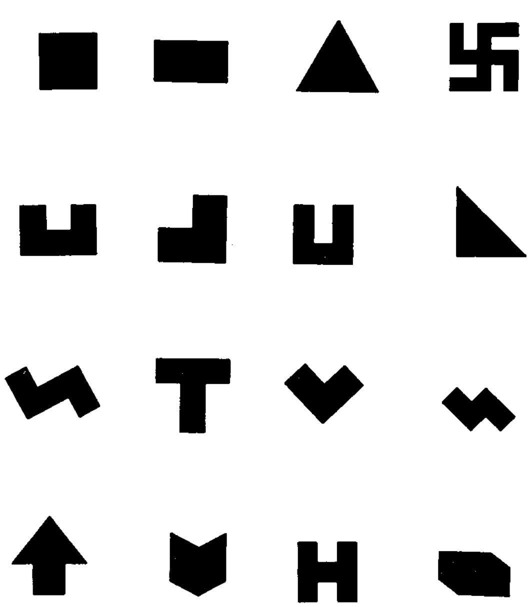

Fig. 11. Factor K: polygons preferred by artists.

and the 16 complex polygons in set A shows that the difference is essentially contributed by the controls. The preference means for simple and complex polygons are 4·1 and 3·9 for the artists, an insignificant difference; for the controls the means are 3·4 and 4·7, a very large difference. In other words, artists like simple and complex polygons equally, and their mean rating is near their mean rating for set B. Controls like complex patterns much better than set B polygons, and set B polygons much better than simple ones.

As far as the difference between artists and controls is concerned, it is possible to use the polygons in set B to measure a general aesthetic factor, in which agreement

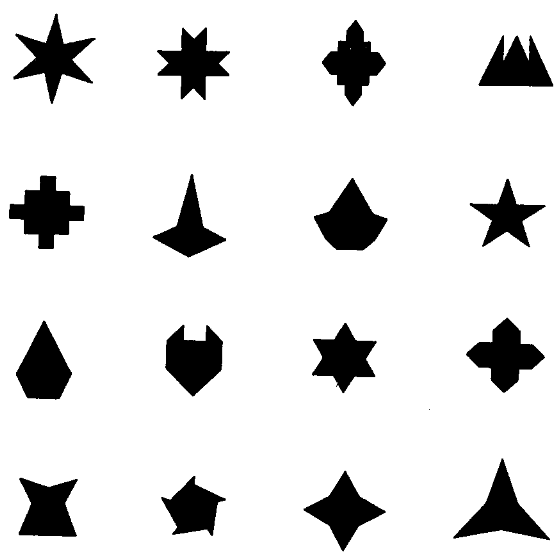

Fig. 12. Polygons preferred by controls.

with majority opinion would be the score, and it is possible to use the polygons in set A to measure an artists *v.* controls factor the nature of which would be rather more difficult to postulate. We could be dealing with the consequences of art training (artists are trained to look for and appreciate order elements and simplicity), or we could be dealing with a process of selection (people who prefer order elements and simplicity are more likely to opt for art courses, and are more likely to be accepted and make good). Or both possibilities might be equally applicable. It must remain for future research to discover the precise causal relations involved.

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