

## The evaluation of architectural interior colour as a function of style of furnishings: Categorization effects

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The purpose of this experiment was to investigate whether evaluative responses to a single attribute, colour, reflected categorization and prototypicality as did responses in a furniture selection study (Whitfield & Slatter, 1978). Subjects ranked colours in order of appropriateness for the walls of a simulated domestic interior furnished in one of three styles: Modern, Georgian or Art Nouveau. Style was designated by simulated items of furniture. The hypothesis that judged appropriateness would vary as a function of style was borne out by the results. Support was also provided for the prediction that two rather than three categories would be referenced by subjects—Georgian and Art Nouveau comprising a unitary category. Finally, evidence of effects due to prototypicality was discernible from inspection of the data.

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As described by Bruner (1957), perceptual categorization entails the placement of non-identical stimuli into equivalence classes/categories, on the basis of certain defining or critical stimulus properties. According to Bruner (1957) and Reed (1972) object perception is clearly the end product of a categorization process. Given that efficient perceptual classification was, and is, essential for survival (Bruner, Goodnow & Austin, 1956; Kaplan, 1973), it seems highly probable that categorization evolved as a source of pleasure to the organism (Humphrey, 1973), resulting in biases in perceptual information processing favouring easy-to-classify stimuli (Kaplan, 1973). Subsequently, Whitfield & Slatter (1978) have argued that many aspects of aesthetic experience are in fact mediated by categorical processing of the stimulus object.

Recently, research utilizing a classification learning paradigm has demonstrated that the strategy by which subjects accomplish categorization involves the formation of an abstract schemata, or prototype, to represent each category, and the classification of exemplars on the basis of their similarity to these prototypes (Posner & Keele, 1968; Reed,

1972). In an extensive investigation of human categorization, Rosch and co-researchers (e.g. Rosch, 1973, 1975; Rosch & Mervis, 1975) have effectively shown that categories are structured in analog rather than digital fashion. Rosch has proposed that categories are unbounded entities centred on prototypes (the best example of a category) with non-prototypic members laid out at empirically determined distances from them, according to their rated goodness-of-example.

Whitfield & Slatter (1978) hypothesized that goodness-of-example (prototypicality) directly affects aesthetic satisfaction. They reviewed several sets of findings consistent with the hypotheses that aesthetic preferences for visual stimuli are governed by (1) the category to which a stimulus object is allocated (e.g. Berlyne, 1975; Gärling, 1976; O'Hare, 1976) and (2) the proximity of the stimulus to the prototype within that category (e.g. Galton, 1907; Handel & Garner, 1966; Garner, 1974). Further support for these hypotheses was obtained in two furniture selection tasks (Whitfield & Slatter, 1978). The first experiment required subjects to select items of furniture from a display similar to

those in a set. The sets consisted of items in one of three styles—Modern, Georgian or Art Nouveau—while the display comprised items of all three. Results indicated the existence of two, rather than three, distinguishable categories. One was represented by Modern and the other by both Georgian and Art Nouveau. However, only the Georgian items appeared to be prototypic of this broader category. The second experiment differed only in that preference selections were required. Results were in broad agreement with those obtained in the similarity task, thus supporting the contention that aesthetic preference reflects both categorization and prototypicality.

Having demonstrated that evaluative reactions to at least one class of aesthetic objects—furniture—appear to be responsive to categorical processing, the purpose of the present experiment was to examine whether evaluative judgments of a single attribute—colour—were similarly effected. Semantic differential studies have shown that evaluative responses to colour are dependent upon the class of objects with which the colours are associated (Osgood, Suci & Tannenbaum, 1957; Sivik, 1974). Similarly, Inui's (1966) survey of colour use in the Tokyo region indicates that the colouration which people consider appropriate to interiors varies with the class of interior. In this sense a link is suggested between affective responses to colour and categorization. Sivik's (1974) results also show a category dependency, though in this case between affective responses to colour as an attribute of colour chips and buildings. He suggests that colours seem to vary in their appropriateness to particular object categories, with highly appropriate colours eliciting more favourable aesthetic reactions than inappropriate ones. These findings and considerations imply that appropriateness judgments of colour may provide some indication of the prototypicality of colours to different object categories.

The present study therefore investigated subjects' appropriateness rankings of a set of colours for the walls of a domestic interior, furnished in one of three styles. The styles were represented by the same sets of furniture items as used previously (Whitfield & Slatter, 1978). Briefly, the styles may be historically described as follows: 'Modern' is considered an adequate description of the style developing from the Bauhaus and such designers as Le Corbusier, Wright and Breuer, and continuing

up to the present. 'Georgian' is a predominantly British style, prominent during the latter half of the 18th and early 19th century. Major figures include Adam, Chippendale and Sheraton. Art Nouveau, from its British origin in book production and textiles in the 1880s, spread to furnishings and architecture and a more international following. Some of the better known exponents of this style are Tiffany, Gaudi and Mackintosh.

The experimental hypotheses were that (a) the judged appropriateness of colour samples for the walls of a simulated domestic interior would vary as a function of style of furnishings—Modern, Georgian or Art Nouveau; and, (b) the categories of style referenced by subjects would correspond to those previously identified for furniture (Whitfield & Slatter, 1978). In addition, it was anticipated that information bearing on the prototypicality of individual colours for a particular style would be obtained, although no specific hypothesis was formulated.

## METHOD

*Stimulus material.* This consisted of a perspective drawing of a room, examples of furniture in each of three styles, and a set of colour samples.

The drawing was designed to provide a room setting, neutral with regard to style and function. As such, room embellishments and furnishings were excluded. The drawing, 50×30 cm, was mounted on a white card, 52×32 cm, and protected with a transparent plastic covering.

Selection of furnishing styles was initially based on the dual criteria that they be familiar to experimental subjects and constitute distinctly different styles. Three styles—Modern, Georgian and Art Nouveau—were selected by a group of five designers as best meeting these requirements. It may be noted that no significance was attached to the selection of only three styles, this number being simply convenient for experimental purposes.

Due to the problems of employing actual furnishings in an experimental design, artificial stimulus material was constructed to represent the three styles. Initial attempts to control the stylistic attributes of the furniture in a series of drawings proved unsuccessful. The solution eventually adopted involved photographing from book illustrations three matching sets of furniture representative of each style. The criteria governing selection were as follows: (a) each matching set should contain sufficient items to permit permutation of furniture arrangements for a living room/dining room, (b) items should be both authentic and representative of their style, (c) each item to be complete, i.e. free from overlap and juxtaposition with other objects, (d) orientation and perspective of illustrations to be compatible. The sets were made up as follows: 5 chairs, 1 large table, 2 small tables, 1 multiple seating unit, 1 writing desk, 1 floor standing storage unit, 1 mirror, 1 light unit

(ceiling attached), 1 fireplace. In order to balance out possible bias in the orientation of chairs, each set contained two left, two right and one centre facing chair.

The furniture items received the following treatment: (a) scale was standardized photographically, (b) texture and pattern were reduced on some items by Xeroxing prior to photographic reproduction, the intention being to standardize detail, (c) backgrounds were removed, (d) each item was mounted on a separate, rigid, transparent plastic sheet and protected by a transparent plastic covering. Two sizes were used as appropriate to the scale of the furniture—11.5×16.5 cm and 14×20.5 cm.

Eight colours were selected from the 'C' greyness category of the BS4800: 1972 'Paint Colours for Building Purposes', for use in the experiment. Sampling was governed by two criteria: first, that a reasonable range of Munsell hue, value and chroma should be present; secondly, that colours should not be markedly different from those encountered as wall colours in modern and traditional interiors, i.e. too dark or too strong. White was added to the eight colours selected from this category, giving a total of nine colours. The Munsell notations are given in Fig. 1. Colour samples, sized 6.5×5 cm, were obtained from the Building Research Establishment, England.

**Subjects.** These consisted of 24 personnel (clerical staff), 10 males and 14 females aged between 18 and 52 years of age, from the Central Office of the Department of Health and Social Security, Newcastle upon Tyne. Subjects were selected from a population of approximately 13 000 on the basis of proximity to the room in which the experiment was conducted. The procedure placed selection outside the experimental control. All subjects were volunteers and none had previously taken part in a laboratory experiment. The Ishihara test (1969) was used to screen for colour vision deficiencies.

**Display.** This consisted of the room drawing, one set of furniture items and the set of colour samples. These were contained within a viewing enclosure, sized 106×82×60 cm. The illuminant employed conformed with BS950: Part 1: 1967 'Illuminant for Colour Matching and Colour Appraisal'. Illumination level was controlled at 1000 lux  $\pm$  80, with surrounds N 6.5 (matt).

**Conditions.** Each reference condition—Modern, Georgian and Art Nouveau—was designated by a set of fourteen furniture items in that style. Eight subjects were assigned to each reference condition, assignment being determined by order of appearance. The order of colours in the array was randomized for each subject.

**Procedure.** Subjects were seated singly at the viewing enclosure and read the following instructions: 'I would like you to take part in a study to assess the colours that people consider appropriate for the walls of domestic interiors. In front of you is a drawing of a room and some examples of furniture. The latter are simply to illustrate a style of furnishings. Would you please select the colour that you consider to be most appropriate for the walls of this room, furnished in this style of furniture, and place it to your right. Beneath it would you place the colour you consider to be second most appropriate and so on, until you have positioned all the colours, from the most appropriate at the top to the least appropriate at the bottom.'

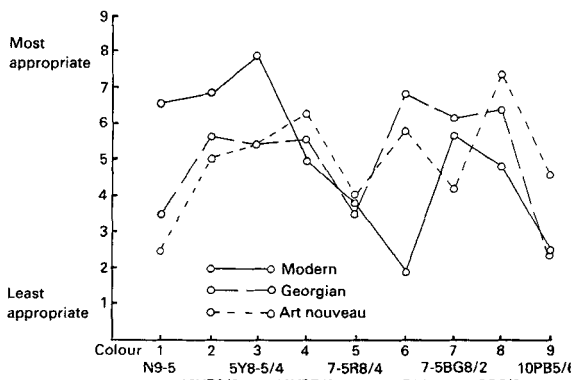


Fig. 1. Reciprocals of mean appropriateness rankings for nine colours under three conditions of style.

You are free to change the position of the colours at any time during or at the end of the session if you wish. There is no time limit. Do you understand?' (If the reply was 'no' the instructions were paraphrased; this happened on two occasions.)

## RESULTS

To provide a measure of the consistency of ranking, coefficients of concordance ( $W$ 's) were calculated for each condition of style. The values of  $W$  were as follows: Modern 0.43,  $p < 0.001$ ; Georgian 0.30,  $p < 0.02$ ; Art Nouveau 0.28,  $p < 0.02$ . To test for independence, that is lack of association between the mean or "true" (Kendal, 1962) colour ranks for each condition of style, Spearman's coefficient of rank correlation ( $\rho$ ) was calculated for each pair of conditions. The values of  $\rho$  were as follows: Modern/Georgian  $-0.09$ , NS; Modern/Art Nouveau  $-0.15$ , NS; Georgian/Art Nouveau 0.64,  $p < 0.05$ .

## DISCUSSION

Support for the hypothesis that the judged appropriateness of colours for the walls of a domestic interior varies as a function of style of furnishing is provided by the absence of association between the mean colour ranks for the Modern and Georgian ( $\rho = -0.09$ ) and the Modern and Art Nouveau ( $\rho = -0.15$ ) conditions. As the level of internal consistency in ranking achieves significance for each style ( $W$ 's), an absence of association implies differences in appropriateness as a function of furnishing style.

Regarding the second hypothesis, there are

strong indications that two categories of style—Modern and Georgian/Art Nouveau (Traditional)—were referenced by subjects in the task, and that these correspond to those previously identified in the furniture selection study (Whitfield & Slatter, 1978). This is evidenced by the absence of association between judgments in the Modern and Georgian/Art Nouveau conditions, and the presence of an association between the Georgian and Art Nouveau conditions ( $\rho=0.64$ ,  $p<0.05$ ). Given that the level of internal consistency in ranking for the Georgian and Art Nouveau conditions is almost identical ( $W=0.30$ ,  $p<0.02$  and  $0.28$ ,  $p<0.02$ , respectively) the presence of an association strongly suggests that the same unitary category was referenced for both styles. A further parallel with the results of the furniture selection task is given by the higher level of internal agreement for the Modern condition ( $W=0.43$ ,  $p<0.001$ ). This is consistent with the mean similarity scores obtained in that study, suggesting a greater familiarity with the defining attributes of the Modern style.

Additional support for the existence of two distinguishable categories derives from inspection of the distribution of mean ranks for each colour over each condition of style (Fig. 1). These show that the major differences for individual colours over style occur between the Modern and Georgian/Art Nouveau conditions, and are symmetrical about the overall mean (5). Both the extent of the differences and their symmetry, particularly of colours numbers 1 and 6, suggest that in relation to domestic interiors at least, colour may function as a 'stylistic trait'. In this sense colour number 1 ('white') appears characteristic of Modern and number 6 ('dark red') characteristic of Georgian.

The notion of stylistic traits has been discussed at length by Finch (1974) and Munro (1963). Basically they conceive of style as a means of classifying different objects as equivalent according to their defining attributes or 'traits'. A stylistic trait is regarded as characteristic of a particular style and used as one of the specifications in defining it. According to Finch a stylistic trait may be any factor pertaining to "form, subject, or meaning" which is sufficiently constant in a group of objects to establish a relationship among them. Munro, however, argues that while a style may be analysed into a set of constituent traits and subtraits some are more typical of the style than others; that is, some, such as pointed arches in gothic architecture, occur

with greater regularity, while others may occur often but not always or necessarily in the same style. In consequence, Munro argues that not all of the traits encountered in the object are stylistic traits, but only those which serve to identify it as an example of a style; these being "those which it has in common with many others of the style, and which do not occur to any great extent in other styles". This description of the structural basis of styles is remarkably consistent with Rosch & Mervis (1975) description of 'family resemblance' as a basis for category prototype formation; namely, that in categorization the validity of a cue, or 'trait' in Munro's terms, is defined as its total frequency within a category and its proportional frequency in that category relative to contrasting categories.

In as much as 'Modern' and 'Traditional' comprise two distinct categories, it might be anticipated that specific colours which possess high cue validity for one category would possess low cue validity in the other. The observed symmetry about the overall mean for colours possessing maximal differences is consistent with this prediction, supporting both the existence of two differentiated categories and, by implication of the family resemblance hypothesis (Rosch & Mervis, 1975), a prototype matching strategy in the experiment. A further characteristic of the distribution of means is that some colours were considered generally appropriate to both categories of style (e.g. colours 2 and 3, 'yellows') with others generally inappropriate (e.g. colours 5 and 9, 'pink' and 'violet'). It may well be that the former colours are appropriate to domestic interior per se and the latter inappropriate. These results are generally consistent with those of Inui (1966) for interiors and Sivik (1974) for exteriors. Finally, it may be noted that the notion that domestic interior styles are subsumed within a larger category is consistent with Rosch et al's (1976) formulation of inter-category structure.

In conclusion, the results supported the experimental hypotheses and may be summarized as follows: first, they indicate that subjects were able to make reference to internal representations of domestic interiors which contained specification on colour appropriate to different styles of furnishings. Secondly, the significant level of agreement in ranking for the categories referenced and their equivalence to those previously identified (Whitfield & Slatter, 1978) suggests that subjects possessed similar internal representations, possibly re-

flecting similar experience of interiors and their furnishings. Thirdly, aspects of the distribution of means are consistent with a family resemblance relationship, suggesting a prototype matching strategy in category referencing. In turn, this implies that appropriateness and prototypicality are closely related. Finally, in view of the evidence previously reviewed (Whitfield & Slatter, 1978) to the effect that aesthetic satisfaction increases directly with prototypicality, it may be inferred that the extent to which a specific colour is found appropriate to a category is a major determinant of aesthetic responses to that colour.

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