CONFLICTING EXPERIENCES OF COLOUR SPACE.

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SUMMARY

The aim of this paper is twofold:

1. To summarise the 'state of the art' on conflicting experiences of colour space based on psychological and architectural interpretations.

2. To present the preliminary findings of ongoing longitudinal studies at Oxford on colour attitudes to full scale colour spaces by architects and laymen.

Conflict is considered at several levels of conceptualisation. Conflict within the individual depending on his physiological and psychological state. Conflict within a group in their experiences and attitudes to colour spaces. Conflict within a group between personal evaluation and social evaluation. Conflict between groups in their perception and response to colour. Architects' colour taste will be compared to the taste and aspirations of laymen. Conflict as a result of differences due to age and sex. Conflict arising as a result of the architectural dilemma: What we know about colour as scientists and psychologists and what we do as artists and architects. The distinction will be made between synchronic conflict - apparent conflict at any given time - and diachronic conflict - brought about through changes mainly the time factor but also taste, habituation.
GREETING

Greetings, Harriet the frog here and today
I’d like to tell you a little bit about the
colour green.

Do you know what’s green?
Well I am for one thing. You see frogs are
green and I’m a frog and that means I’m
green, you see.

It’s not that easy being green
Having to spend each day the colour of the leaves.
When I think it would be nicer being red or yellow
or gold or something much more colourful like that.

It’s not easy being green
It seems you blend in with so many other ordinary things
And people tend to pass you over cos you’re not
Standing out like flashy sparkles in the water or
stars in the sky.

But green’s the colour of spring
And green can be cool and friendly like
And green can be big like an ocean
Or important like a mountain or tall like a tree.

When green is all there is to be
It could make you wonder why
But why wonder, why wonder
I am green and it’ll do fine
It’s beautiful and I think it’s what I wanna be.
Has Kermit got an identity crisis about his colour, a conflict between his self-image and self-esteem? Can we explain his problem by reference to conflict theory or is it a case of rhyme with reason?

Conflict can start within the organism, in both animal and man, when a drive is aroused and there are restraining forces which prevent the goal being attained. The animal may satisfy his drive at any cost or may resort to a characteristic displacement activity: for example a 3-spined stickleback in conflict about whether to attack or escape sometimes resorts to digging the sand nearby. In the same way in a situation of conflict or stress we may scratch our head. Conflict may also be satisfied in an indirect way depending on the relative strength of the approach and avoidance drives: the animal moving towards an equilibrium position where both approach and avoidance forces meet.

An architect wanting, or considering it desirable to use colour in his design, on the one hand (approach), but fearing, or being ignorant of, its possibly undesirable effects on people on the other hand (avoidance), may go a little way towards his original goal by using a few pastel colours - of the type we see in schools, hospitals and public buildings - which, although they will not offend anybody, may not be the answer to his problem (which might best be served by either using strong saturated colours or no colour at all?).

The way we experience colour, however, does not solely depend on a definable conflict. Kermit's dilemma as to whether he wishes to be 'red or yellow . . . or something much more colourful like that' is more likely to be the result of a change in his mood: a thought, an expectation, an emotion could influence his autonomic nervous system and as a result he would experience a rise in metabolic rate, dilatation of his pupil size and constriction of his sweat glands.
An existing colour space may provide us with a pleasant and warm experience but equally, as a result of our physiological and psychological state, we could experience it as cold and miserable, depending on the mood we project into it.

The theme of this conference on conflicting experiences of space (including colour space) can be considered at various levels of conceptualization:

1. Conflict within the individual organism as a result of physiological and psychological drives: using Freudian terminology, conflict between and within the id, ego and superego: conflict between hereditary and environmentally determined drives. Conflicts arising as a result of internal changes within the organism, as a result of changes in mood, state of preparedness and emotions of the type we have discussed above.

2. Conflict between individuals as a result of individual differences in, for example, personality, intelligence, interest; again considering whether the differences arise as a result of biological predispositions or environmental conditions as well as the interaction between them.

3. Conflict arising within and between groups as a result of age, sex, shared experiences, education and culture.

4. Conflict between aesthetic and social values, between expressed and expected realizations.

5. Conflict arising as a result of the Architectural dilemma: what we know about colour as scientists and psychologists and what we see as artists and architects.

In the context of this paper it may be useful to make the distinction between synchronic conflict - apparent conflict as it is found to exist at most levels of conceptualization at any given time, and diachronic conflict brought about as a result of the time factor. Diachronic conflict can occur within the individual or group as a result of habituation, changes in tastes, etc. In this connection some
preliminary results of ongoing longitudinal studies at Oxford on the attitudes of architects and laymen to colour spaces will be discussed.

Our first task is to identify where differences in colour experiences, with particular references to colour space, exist and secondly, where possible, to investigate whether these differences are biologically or environmentally determined. If we go some way in dealing with these two problems we may then be in a better position to understand the nature of the conflicts that arise in our experience of colour space. It is also of equal importance to sort out where there are no differences or conflicts and where colour experiences are the same in all of us. It seems to me that it is within this framework that we might be able to resolve yet another fundamental conflict which designers constantly face when they look at conflicting reports on colour work as presented by research papers and the mass media.

Let's look at a few examples:

Rile crash helmets found 'totally unfit'. The Observer (3 June 1979)

... One of the most surprising conclusions from the data is that orange and red helmets made of polycarbonate (the material used in most plastic helmets) seem to shatter remarkably frequently... The team reports: 'There is obviously an extremely significant correlation between the colours in the red spectrum and helmet damage.'


The district of modern architects for bright colour is responsible for vandalism and other social ills. Research has shown that settings starved of visual stimulation can cause frustration and anxiety in their inhabitants.

Black underwear's secret is revealed. Daily Telegraph 1976

Colour schemes at home and at work can have a major influence on people's health, efficiency and sex lives say an architect... Black underwear has an international appeal for men because black is a colour associated with surrender.

The long and short of Colour Distance. Architectural Record 1960

In this report on a recent colour study a scientist raises some pointed questions about the effect of colour on apparent room size, and contradicts some architectural rules of thumb. For example, participants in the experiments found that a black panel seemed further away than a white panel at the same actual distance. In a black room, then, 'larger' than a white one?
'The Psychology of Aesthetics' in Sense and Nonsense in Psychology

pelican (1964)

This agreement is still manifest when we are less careful to keep brightness and saturation equal for all our colours, but it is much less strongly marked, because judgments are now based not on one characteristic (hue) only, but on a combination of several. Nevertheless, considerable agreement is still found, even when we compare European subjects with savage tribes, American whites with Red Indians, and subjects from Oriental with subjects from Occidental cultures. There thus appears some strong biological foundation for judgments of colour preference, a foundation which may occasionally be overborne by cultural influences but which asserts itself in all the many diverse groups studied.

There seems to be a definite physical property in the stimulus which is responsible for this universal order of preference. Short wavelengths are generally preferred to long wavelengths; the correlation between wavelength and preference is almost perfect. For young children this relationship does not appear to hold, but for adolescents and adults it appears to constitute a natural law.

Very few architects these days will deny that some of the issues on colour psychology concern them both directly and indirectly in design especially those who consider their role to go beyond that of the creative engineer and to be one encompassing greater understanding of how people perceive and react to the environments they create for them. What is important is that their present education neither enables them to look critically at the information available on colour psychology nor prepares them seriously for this wider role.

During the 'Colour in Architecture' symposium held in Winchester, England, on 5 December 1978, it became evident that many relevant questions remain at best unanswered and at worst unformulated and misunderstood: what is worrying further is the conflict arising from insufficient knowledge, lack of clear experimentation, poor interpretation of experimental results, not reading the small print and the sensationalising effects of the mass media.

Faced with the complex world of colour, the designer turns to the specialists and other authorities who have written about the subject and to find it in a state of confusion which only adds to his own. There
has, as yet, been no worthwhile attempt to bridge the gap between the
designer and the artist on the one hand, and the physicist,
psychologist and optician on the other. For the artist and the poet,
colour contains some mystical power, its potency being so dynamic and
intangible that the very attempt to define it may be considered an
anathema. Fernand Léger’s description of colour is typical of this
approach. In fact the chord struck by the messages of the arts
whether music, painting or poetry is nearer to us and appeals to our
emotions more than the cool scientific expositions of the dimensions
of colour in terms of electromagnetic radiation and the other
quantitative attributes of our visual experience.

The difference between the artistic and scientific standpoints is so
vast that the designer could never take sides or ignore the whole
question of colour. Confronted with this dilemma the environmental
designer may find that the artistic approach allows his freedom of
expression without having to account to the rationality of the
scientific experiment: his intuitive flair, his experience and
feelings could be translated into tangible form which is enormously
appealing to him. To the designer taking the scientific direction the
very rationality of the scientific method, the fact that so many of
his preconceptions are challenged and even refuted may lead him to the
systematic method of investigation in an attempt to understand more and
increase his knowledge about our perception of colour and he may be
prepared to use colour only in cases when he is absolutely certain of
understanding its effects on people.

Which of our two hypothetical designers has taken the ‘right’ decision?
Their individual contributions are impossibly to assess as we have no
valid criteria for judgment. To the independent observer, however,
the very possibility of having a choice which may be catastrophic
either way, is frightening. The intuitive, creative character may
turn up with something which satisfied his own idiosyncratic urge but
is incomprehensible to his foes; the rational person, on the other
hand, who has studied Newton’s and subsequent theories of colour
perception may, in defence of the nature of the empirical science, make
no statement at all. The dictum of Donald Broadbent in his book
‘Behaviour’, 1965, may prove too forbidding: ‘Against the perspective
of two thousand years the speed of an advance in studying human nature
seems more cheerful. At a rough guess, two hundred more years may
bring study of behaviour up to the level which physics reached in Newton’s time'. What seems to have gone wrong in our hypothetical designer's dilemma is his failure to identify the problem, to recognize what we know and what we don’t know and to put this knowledge into perspective alongside his creative talent.

It might be useful at this stage to consider the nature of the colour RED because it will bring some of the conflicts discussed so far into sharper focus:

Do we all experience red the same way, or, as some people argue, our perception and reaction to it is much more the result of culture, tradition and fashion? Until 1969, red traffic lights in China meant contrary to their meaning in the West. What is a blue joke or a blue movie in England is a yellow joke in Hong Kong and a pink one in other oriental cultures.

Let’s consider now some of the evidence: in one of the best accounts on the subject, Nick Humphrey, Assistant Director of the Department of Animal Behaviour at the University of Cambridge, summarizes in a variety of contexts why red seems to have a very special significance for Man.

1. Large fields of red light induce physiological symptoms of emotional arousal - changes in heart rate, skin resistance and the electrical activity of the brain.

2. In patients suffering from certain pathological disorders, for instance cerebellar palsy, these physiological effects become exaggerated - in cerebellar patients red light may cause intolerable distress, exacerbating the disorders of posture and movement, lowering pain thresholds and causing a general disruption of thought and skilled behaviour.

3. When the effective value of colours is measured by a technique the 'semantic differential', which is far subtler than a simple preference test, men rate red as a 'heavy', 'powerful', 'active', 'hot' colour.

4. When the 'apparent weight' of colour is measured directly by asking men to find the balance point between two discs of colour, red is consistently judged to be the heaviest.

5. In the evolution of languages, red is without exception the first colour word to enter the vocabulary - in a study of ninety-six languages Berlin and Kay (1969) found thirty in which the only colour word (apart from black and white) was red.
6. In the development of a child's language red again usually comes first, and when adults are asked simply to reel off colour words as fast as they can, they show a very strong tendency to start with red.

7. When colour vision is impaired by central brain lesions, red vision is most resistant to loss and quickest to recover.

Red, as Humphrey concludes, is found by man as a species to be both a uniquely impressive colour and at times a uniquely disturbing one. The crucial point of our discussion earlier as to the nature of the Red Experience is I think in the recognition that Red is a SIGNAL for Man irrespective of culture, education and learning; it is the meaning we assign to this signal, however, that sometimes depends on learning and the context in which we see it. A red berry, for example, will stand out against its complementary green foliage; but this alerting signal will have to be tempered by experience before a gustatory response to its delicious nature or an avoidance reaction to its poisonous nature is experienced. Once aware of the distinction, designers could use it to advantage: 'They can continue to devalue colour by using it in an arbitrary non-natural way, or they can recognise and build on man's biological predisposition to treat colour as a signal. If they choose the latter, bolder course they might do well to study how colour is used in nature. Nature has, after all, been in the business of design for over a hundred million years.' Humphrey 1976.

The above discussion on the nature of the colour red can of course throw some light on our responses to colour in general. Although it does not provide the answers to all our problems it does provide a significant standpoint which is often ignored in architectural education. Evolution has taught us many useful lessons and could provide us with more answers as to how man biologically adapts to his changing and new environments.

In looking at nature we seek prime examples: not only of warning coloration but also of concealing coloration (see poem by Whitman the frog). In fact this difference is not unlike 'conservation' laws, or the architect's aesthetic of harmony and rhyme (whether particular colour exterior schemes fits in the environment in question). Animals have developed superb colour schemes for camouflage (for example, to resemble a twig on a lichen covered branch) or for display to frighten...
predators. It is interesting in this context to note that the main warning colours in nature are red and yellow usually contrasted with black, which is identical with the warning colours of the western traffic lights. These colour schemes whether for camouflage or warning have not evolved by chance but for the biological survival of the organisms. In the case of the celebrated peppered moth a darkened specimen of the moth was taken in polluted Manchester in 1948 and by 1995 98% of the moths in the Manchester area were of this dark form which is inconspicuous against trees blackened by soot.

Let's move now from evolutionary theory to some recent research carried out in Sweden in the 60s and 70s. This research is of special interest to us because a new system of colour notation (the MGR) was introduced in Scandinavia by Anders Hard which had several advantages over comparable European and American systems. It is simple to learn, both for architects and housewives, it can be used as a conceptual system, without reference to a colour Atlas, using the eye as the measuring instrument and research was forthcoming by eminent psychologists like Sivik, Rikard Kühler and Professor Carl-Axel Acking on colour connotations for interior and exterior spaces. That was the first time that research moved outside the psychology lab, from patches of colour to colour in context and later on to validating some of the research findings in real-life experiments. This is amply documented elsewhere. The reason for mentioning this work here is that it questions some stereotype views we hold about colour experience (and also provided a few more instances in our discussion of the colour red). In addition it stimulated further work in the field and the long awaited Colour Atlas is at last going to be published this year.

One of the first findings of this work was to question Speronek's universal order of colour preference mentioned earlier. The Swedes have produced evidence, in both interior and exterior colours, that there is more variation within each hue than between hues and that the dimensions of chromativeness (saturation) and lightness (brightness) influence personal preferences more than hue. Although this research was more sophisticated, both in the design experiment and the use of the semantic differential technique, than the simple minded colour preference tests that were carried out in the past by asking people to put 6 colours in order of preference and then by using Kendall's Coefficient of Concordance(w) a significant order was pronounced, the
Swedish research still lacked the support of cross validation studies employing alternative methods of investigation; this support was not forthcoming. In fact N. Humphrey in 1972 and 1975 developed a new behavioural measure for testing colour and brightness preferences in monkeys. The monkey sat in a dark chamber with a screen at one end onto which visual stimuli could be projected under the monkey's control. To exercise a preference the monkey had simply to hold the button down when he wanted the current stimulus and release and press again when he wanted the other. Under these conditions Humphrey found that 'the colour preferences were monotonically related to wavelength', monkeys having 'a strong avariance to light at the red end of the spectrum'.

Although work on colour preference is of no direct value to the designer, viz. even if we produced evidence for a universal order of preference related monotonically to wavelength, it is clear that the architect could not provide us with a uniform blue environment! It is however of interest to put the record straight: to be critical of the state of the art and provide some answers towards sensational theories. It is academically an interesting study especially in its relationship to pleasantness evaluation: it provides a forum for improving the design of experiments and above all highlights the difficulties involved in interpreting experimental data. For me it also demonstrates that the best way to increase our understanding of colour experience is through experiment rather than armchair experimentation. In an ingenious experiment by Humphrey (1977) he questioned his earlier findings that rhesus monkeys find blue light more pleasant than red and suggested that monkeys judge 'subjective time' to pass nearly twice as fast in red light as in blue. 'At a behavioural level the most that can safely be said from this series of experiments is that monkeys 'do things faster in red light than in blue'. This phenomenon may have nothing to do with liking or disliking of the colours but may instead reflect an influence of colour on the passage of subjective time'.

Thus, what started off as a colour preference experiment turned out to be one involving the testing of several hypotheses.

1. The original hypothesis 'that monkeys find red light less pleasant than blue, and hence choose to spend less time with it'.
2. 'Monkeys are more highly 'activated' in red light than in blue and hence less likely to persist with what they are doing'.
3. 'Monkeys have a subjective time clock which runs faster in red light than in blue'.

Although Humphrey considers hypothesis 3 the most plausible one, he does not rule out a causal chain, i.e. 'a faster clock might lead to greater activity which might lead to a feeling of displeasure'.

One of the most widely accepted rules of thumb for colour selection is that the long wavelength colours such as red (orange, yellow) are warmer than the short wavelength colours (blue and green). A Norwegian study showed that people would set a thermostat 3 degrees higher in a blue room than in a red one as if to compensate for the coolness that is visually induced. This rule of thumb is supported by several experimental studies. Lars Sivik has demonstrated that indeed hue is the most important dimension of colour with regard to the apparent warmth and coolness of the colours. (see Figure 2 below)
This is also supported by an experiment on 2 large seminar spaces at the Oxford School of Architecture, one painted red (BSI G485) and the other Turquoise (BSI 16245) (see Figure 5).

![Diagram](image)

Both architects and laymen agree with each other about the relative warmth of the 2 places. For the Red Space the values were Architects $\bar{x} = 2.5$, $\sigma = 1.4$ and Laymen $\bar{x} = 2.1$, $\sigma = 0.9$. For the Turquoise space the values were Architects $\bar{x} = 5.0$, $\sigma = 1.2$ and Laymen $\bar{x} = 5.4$, $\sigma = 1.13$ $p < 0.001$. Similar significant differences were found in another experiment involving the evaluation by architects and laymen of 4 identical sized corridors, coloured in blue, orange, red and purple (see Figure 9).

The orange and red corridors were judged as the warmer by both architects and laymen whilst the purple and blue corridors as the cooler. The difference between the 2 groups of colours was statistically significant at the $p < 0.01$ level of confidence.

Some researchers, Berry (1961), Benneit and Ray (1971), suggest that the effect of hue on warmth is an intellectual one rather than one we can physically notice. Although scientists may still have to resolve
whether the perception of warmth induced by the long wavelengths is a behavioral or a cognitive process, or a mixture between the two depending on context, the effect on people, whether architect or layman, remains the same.

Both experiments by Sivik (1976) and Mikellides (1978) support the general rule of thumb about the apparent warmth and coldness of colours. One should however consider the relevance of other attributes, such as texture, which could influence perception of colours along several meaning scales. Sivik poses the classic question: 'Which, for example, appears the warmer, an ice-blue woollen sock or a red plastic bag? Such circumstances may cause a conflict of feeling, and to resolve it one is forced to distinguish between the object and its colouration'. Another rule of thumb, however, is not supported by empirical research. Sivik (1976) has shown that it is not hue which affects how exciting or calming a colour is but the chromaticness (saturation) of each hue. (See Figure 4 and compare the 2 samples marked O and X in the triangles for yellow, red, blue and green).
Sivik's results are very interesting for designers. They mean that one can find a green high on chromaticness which is more exciting than a dull red. Although this may appear paradoxical, in view of what we have said earlier about red, it is borne out by experiment.

In the evaluation of the Red and Turquoise Seminar Spaces, described earlier, both architects and laymen in a variation of Sivik's experiment, considered both spaces to be exciting (see Fig. 3).

The ambiguity of red as a signal has been noted earlier; it can either impress or disturb. We have also considered that this ambiguity is sometimes resolved by reference to the context in which we experience it. Does the Red Seminar Space provide a familiar context for architects and laymen to accept and love or an unfamiliar one to irritate and disturb? (see Fig. 5).

At first glance there appears to be no significant differences between Architects and Laymen. In fact, apart from some higher values by the architects' group on originality and complexity, there is surprisingly good agreement between them.

On personal evaluation (like-dislike) for example the mean scores are (Architects \( \bar{X} = 4.2 \), Laymen \( \bar{X} = 3.9 \)). Their apparently neutral scores
on personal preference are the result of very high and very low scores on personal evaluation (Architects $SD = 1.4$ and Laymen $SD = 2.24$). This was indeed tested by reference to the description of the space by means of adjectival checklists. The results point towards the 'ambiguity' property of red: some people like it a lot (pleasant, cheerful, relaxing, comfortable) while others strongly dislike it (oppressive, restless, uneasy, uncomfortable, depressive, unrestful). These extreme views were shared by both architects and laymen.

Certainly, on this evidence alone, red in this context is a highly risky colour to use (especially if we are interested in initial reactions). Also neither of the two groups considered red to be consistent with or to fit in with their expectations of a seminar space. It would be interesting to consider whether there is a diachronic conflict between people's initial reaction to the Red space and their reaction after they have been there for some time. Blivik has raised the question in 1975 'Another common stereotype is that you must avoid strong colours in your immediate surroundings, or you will get 'tired of it in the long run' you will go mad, you will get a headache, and so on. Most probably from the point of the objective experience one would get used to the colour and after a time not notice it at all.' Although Blivik's observation raises several serious questions on the diachronic nature of the colour experience, the results of the architects evaluation of the Red Space point in that direction (see Fig. 6). One should be very careful, however, in interpreting the higher values in personal evaluation as indicating a favourable change in their attitudes towards red; it may mean that they are more prepared to 'put up with it' now than before as is indicated by the choice of some of the adjectives on the adjectival checklists.

On personal evaluation the values for October 1978 were $\bar{x} = 3.2$, $SD = 1.4$ and for 4 July 1979 $\bar{x} = 3.12$, $SD = 1.16$, $t = 2.75$, $p < .01$. There was no significant difference on the F test. It is also interesting to note that the architects' scores on the 'finite in' scale were also higher though not statistically significant.

How far does the change in context affect the perception of the same Red colour? Does it change the balance of its ambiguous properties when it is used in the context of a corridor or toilet? Fig. 7 shows the profile of the same Red applied in a corridor (2m x 20m).
Both architects and laymen, especially laymen, in general like red more in this context than in the Red Seminar Space though the differences are not statistically significant. Both groups also think that it fits better in the corridor than in the seminar context. In this context red also scores higher with both groups on social evaluation, again especially with laymen. It must also be emphasized that just like the Red Seminar Space, the variance for both groups was very high and the extreme views expressed were shared by both architects and laymen and verified by an adjectival checklist type of analysis. (Architects SD = 1.9, Laymen SD = 1.75). This high variance in the results shown above may partly explain why the Red toilet (BE 04253) has been repainted to a 'more neutral colour' as students complained about it. It may also relate to Humphrey's observation that people's subjective time clocks - just like monkeys - run faster in a red toilet than in a blue one. (According to one 'report' - when toilets have been painted red in a factory people spent less time in them).

In looking at the experimental reports on people's perception of Colour Spaces it is important to search for other variables such as sex, personality and attitudes in order to explain some of the variance in the results. There has been very little experimental work in this area but one first and second year architectural students at the Oxford School have been exploring in this direction. Halse and Hussain (1975) have shown that there are no significant differences in the evaluation of yellow (BE10253), orange (BE15255) and purple (BE25257) corridors (2m x 20m) by male and female users but highly significant differences for the red corridor between the 2 sexes. (Female X = 2.4, SD = 0.95, Male X = 4.1, SD = 1.95) X² = 7.96 p < 0.001.

In another experiment Nick Baylis (1976) has shown a positive correlation, ρ = .7 p < 0.001, between the Conservative Scale devised by G. D. Wilson and colours in short wavelengths of the spectrum, i.e. low scores in the Conservative Scale (liberalism) were related to preference for the long wavelength colours (Red, Orange and Yellow).

On the Personality scales of Extraversion-Introversion and Neuroticism, Baylis has not found any statistically significant correlations; it was interesting to note however that ambiverts tended to prefer the short wavelength colours and people with very high and low scores on Extraversion-Introversion preferred the long wavelength colours.
P. A. Swift (1976) explored yet another dimension: colour dreamers vs. non colour or partial colour dreamers. He asked both groups to evaluate the orange entrance space in the College (HODRIG1) along several semantic scales. Colour dreamers evaluated the space as more exciting, elating, imaginative and inspiring, than non or partial colour dreamers: $p < 0.001$.

One of the most interesting differences between male and female students was shown in a series of interviews conducted by Ask and Brumba (1976) when both groups were asked to talk about their experience of a college building which had been painted inside with strong saturated colours. The corridors in each floor were painted blue, orange, yellow, red and violet. Women's attention seemed to have been attracted more by colours than that of the male students ($p < 0.001$). Another important difference was in the way male and female students used the different coloured corridors as a means of orientation, i.e., in determining which level they were on; over a period of 3 years women used colour as a means of orientation more than men, 50-60% of women as opposed to 28% of men used colour as a means of orientation ($p < 0.05$). Men relied more on labels and other cues.

It would be appropriate at this stage of our discussion to pause on from the conflict arising as a result of individual differences to the broader conflict between the tastes, aspirations and expectations of the professional and those people he is designing for: one of the most important protagonists in this area is Oscar Newman.

"The architectural education process produces severely disoriented practitioners. Not only are young architects kept ignorant of the tastes, values and perception of the client groups they will be serving, they are intentionally trained to be antagonistic to them. I recently attended a community meeting in which a young, black architect was presenting a preliminary design for a housing project to be built in the neighbourhood he grew up in. He was representing a large firm, and to make his link with the community evident he brought to everyone's attention the fact that his mother was in the audience. He then went on to present a very contemporary, concrete high-rise scheme. The community rejected his plan. His mother's astonishment at her son's design was only aggravated by her public embarrassment."
In 1969 I carried out a simple experiment to find out whether architectural students, qualified architects and laymen had different criteria for judging architectural stimuli, such as holiday chalets. The results were as expected. Architectural education seemed to divorce the student from the layman’s viewpoint. In another experiment in 1970 it was shown that old people (whether in state-provided or free private homes) agree with each other as to what they are judged to be their most important design requirements. First Year architects’ predictions of these requirements were close to these results while with Second and Fifth Year students a negative correlation was shown (\( p = -0.5, p < 0.05 \)).

Do colour tastes differ from architect to layman? The experiment by Oscar Newman in the upgrading of Crown Point, New York is a case in point. Newman, observing how middle-class people enrich and individualise their homes by adding colour and texture, persuaded the Housing Authority to provide additional funds for such improvements. "The test results of the experiment proved most fascinating. Not only did people respond by painting their own doors and windows in the first year - but in subsequent years they made extensive improvements to their gardens and to the interior of their houses. Rich colours and materials began to appear on the grounds and insides of apartment units." Newman concludes: "the low income residents were also found to be very articulate on the subject of colour and texture and knew exactly what they wanted their immediate environment to look like. They were very clear about their likes and dislikes. And their tastes are completely at variance with the tastes and values acquired at school ... they say (the architectural profession) that I have catered to the lowest level of taste amongst the residents and that as an architect I have the responsibility to elevate the tastes of my clients. I can imagine that there are many architects who would have used a single uniform subdued colour for the entire project ...” (Newman 1976)

The results of Oscar Newman’s experiment highlight the problem of differences between architects and laymen - and significant differences at that. I think, however, that this situation is changing; there is some evidence, at least amongst young architects in Britain today, that their actual colour taste may be the same as that of laymen.

The differences may arise however in terms of not knowing whether their taste ‘fits in’ with environment (or whether it is consistent with
planning laws, honesty of materials, etc.). In an experiment carried out at Oxford, the attitudes of designers (architects and urban designers) and laymen (non-academic laymen and scientists) to external colour was tested. Slides of coloured building, supergraphics, restoration work of the medieval facades of Rochehut, Germany, by Gerhard Schweizer, Ricardo Noilfe, Le Muralla Roja, Spain, etc. were evaluated along several semantic differential scales. The results are quite interesting; both architects and urban designers expressed stronger preference for colour in buildings than the laymen and scientist groups. However, despite this stronger preference in personal evaluation, both architects and urban designers did not consider the buildings as consistent with or fitting in to the urban milieu. (Architects: Like score $\bar{X} = 3.76$, 'Fits in' score $\bar{X} = 4.8$. Urban Designers: Like score $\bar{X} = 2.7$, 'Fits in' score $\bar{X} = 3.85$, $p < 0.001$.) On the other hand there was no difference between the Like and 'Fits in' scales for the laymen and scientist groups.

That people like and respond to colour in the environment to a greater degree than the architects anticipate, or provide for them, in the grey cement blocks of some modern design, is amply documented in popular and scientific literature. But it is equally dangerous to postulate that where architecture is poor colour is the remedy. The experiment in La Defense outside Paris does not provide the answer to our housing problem. As Walter Segal, June 1979, put it: "To humanize huge structures by architectural means is an unrewarding task. The loss of identity, the divorce from the ground and the collocation of open space pose dilemmas that cannot be disguised by shape, texture, colour and proportion. A good view over landscaped spaces compensates only a few. The human animal does not appreciate being reduced to the scale of a termite'.

Colour does not cure vandalism nor does lack of colour cause vandalism as one occasionally reads in the press. It is true that until now most supergraphics on walls have remained intact. But it is also true that many colour schemes have been vandalized by graffiti. The Aglesbury Estate in London and the Markisches Viertel in West Berlin are prime examples. The Pruitt-Igoe project in St. Louis, Missouri, U.S.A., despite some use of colour as an afterthought, was finally downgraded. In an experiment concerning 6 identical Library Cubicles in an Oxford Library, all painted in different colours (Blue,
(Yellow, Orange, Green, Red and Purple), the amount of graffiti in such one of them was the same as that in a white cubicle - although the content may have made an interesting social psychological experiment.

Earlier on in the context of discussing the nature of the colour Red, reference was made to diachronic conflict and the extent to which we get used to, and become familiar with, colours. There have been very few longitudinal studies to enable us to discuss this issue satisfactorily. We need to know not only whether we get used to colours in various contexts but also whether our attitudes towards them change. In an interesting experiment Divik has shown that although people disliked strongly the idea of living in ‘blue’ apartments when tested in the laboratory, their attitudes while living in real-life blue apartments were significantly different and they very much liked them. Divik explains this shift in attitudes by reference to habituation theory. People in another area whose ‘blue’ apartments are visible, ‘reacted positively to its blue colouration but not as much as the residents of the blue-area themselves’. On the other hand people’s attitudes towards violet colouration (low in chromatic strength) did not change even when ‘habituated’. The results of the coloured corridors experiment mentioned earlier also point to a strong dislike of both architects and laymen for the violet corridor (552/357). Figure 8 shows the semantic profile of the violet corridor and Figure 9 the relative preferences by both groups of architects and laymen for the other identical corridors. This dislike for the violet corridor has been consistent over the period of the last 4 years since it was painted.

In another experiment where architects evaluated their main lecture theatre as soon as they joined their architectural course and where green (555/545) was the predominant colour, they evaluated the space as green, cold, serious, formal, ordinary and comfortable. Both the frequency and the weighted total of the adjectives used was taken into account. In evaluating the same lecture theatre 3 years later the colour green was very low down the list and the space was seen as boring, dismal, monotonous, ordinary and heavy.

In the evaluation of Les Haras du School in Cergy-Pointoise, architects and urban designers express stronger preference for the school than laymen and scientists. It is interesting to note that laymen (French
mothers who take their children to school) really like the building as compared with the laymen who evaluated the building as seen on slide alone (t = 3.61, p < 0.01). The building is also seen to 'fit in' to the environment more by the French mothers than by the comparable English sample. This favourable change in attitudes towards the school is similar to the change in attitudes towards the 'blue' town in Gothenburg referred to above.

One should compare whenever possible not only how architects, laymen, mothers, see the school but also how the children themselves see it. Children were asked to write a few words with reference to the colour of the school and the results indicate that the children like the colours: ('The School is very colourful. I find the colours very vivid and beautiful' pleasant, gay, original). It would be a pity, so the paint is now flaking off, if the school were repainted in a neutral colour for reasons of convenience (see Fig. 10).

The aim of this paper, in line with the theme of the conference, is to conceptualize some of the conflicts which exist at any instant and those which are the result of change. Rather than discussing one particular experiment in detail an attempt was made to find some common ground between several diverse experiments. The rather lengthy discussion on the colour Red was not made disregarding other work but to emphasize that this line of investigation is usually omitted in architectural discussion.

In some of the instances we have seen that rules of thumb hold, while in others we have questioned them in so far as we can interpret the results accurately - and we have encountered several difficulties in
this. In sorting out some of our feelings, views and other rules of thumb not included in this already lengthy report such as ‘apparent spaciousness of colours’, ‘apparent weight’, ‘bodily evaluation’, the Swedish studies are still ahead on points. For example, despite some questioning the ‘long and short of colour distance’ the overwhelming evidence is that the dimension of lightness and not blackness is positively related to apparent spaciousness.

Finally, I hope this paper will bring into sharper focus the difficulties in interpreting data and relating them to design as well as emphasizing the need for longitudinal studies on our experience of colour space.

References:

Mikellides, B.(Ed.) Architecture for People Studio Vista, London 1979