

## Effect of red vs black clothing on the impression of persons engaged in a dialogue

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Effects of clothing colour (red or black) on personal impression were examined. Forty-one participants watched slide shows that displayed written dialogue between two persons with their pictures (but without their faces), each wearing either black or red clothing. Two dialogues were prepared; in the ordinary dialogue two girls were talking about their favourite cookies and crackers, and in the flirtatious dialogue a girl talked to her friend about her recent flirtatious affair. After watching each slide show, participants were asked to estimate the personality of each character. Results showed that the clothing colour influenced estimated personality of the wearer only in the flirtatious dialogue; red clothing enhanced a positive impression of an optimistic character, while black clothing enhanced a perceived social desirability of a discreet character. It was suggested that these effects of clothing colour are not universal, but context-dependent; they would be manifested by interacting with one's original personality that could be judged from other explicit cues.

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### Introduction

The psychological effects of colour have always attracted the interest of many people. Since the colour we see is in itself subjective and psychological, it is natural to expect that any colour has some effect on our feeling, thinking, and behaviour. Indeed it would not be too much to say that all artificially-given colours, from the colour of wrapping paper to the colour of a building's outer wall, are used with an intention to have some effect on us. For instance, blue lighting has recently become very popular in Japan, being expected to have effect on preventing crimes [1] and stemming suicides [2]. Although these kinds of particular use of colour are sometimes criticised to be lacking in theoretical background and empirical evidence [3,4], the fact is that people do expect colours to have some effect, and application is getting more and more prevailing in various scenes of our daily life.

Also in laboratories, since a hundred years ago [5], considerable attention has been paid to the colour effects on a wide variety of human activities such as motor efficiency [6,7], grip strength [8-10], time estimation [11,12], emotional state and responses [13-15], and physiological responses [12,16,17]. Some studies revealed, while some studies failed to show, the expected effects of colours, thereby suggesting both a potentiality and limitation of the colour effects. For example, Takahashi [18] examined the effects of colour lighting (red, green, blue, and yellow) upon performance of the Kraepelin-type addition task, but found no significant colour effects. It was discussed that in this kind of simple task participants might have easily devoted themselves to the required work, thus making potential colour effects difficult to be detected. Therefore, Takahashi [19] re-examined the effects of colour lighting (red, blue, and white) by changing the experimental task to a more cognitive one; to judge talkers' emotional expression and estimate their personalities after listening to short conversations. That experiment yielded more positive results than the previous one; participants judged talkers to be more emotional under the red lighting than under the white lighting only when the conversation didn't include emotional words. As for the estimated personalities of talkers, on the other hand, no colour effect was found to be significant. These results suggested that the environmental colours such as colour lighting would be able to affect our judgement in some cases, but these effects are likely to disappear when we have other explicit cues for judgement (e.g., emotional words), or when we make a judgement on the internal impression of a person rather than the external impression of a certain behaviour.

When considering the colour effects on personal impression, it is plausible to suppose that one's own colours, such as skin colour, hair colour, clothing colour, and so on, should be more effective than the environmental colours. Among others, the effects of clothing colour (or background colour of one's photograph), particularly of red, have been recently paid much attention to by researchers. Elliot and Niesta [20] showed that female images framed by red were rated higher by male raters than the same images framed by other colours (white, gray, green, and blue). They interpreted these results from the viewpoint of socio-biological function of the red colour. Later, Elliot and his colleagues [21] extended these findings to male attractiveness judged by female raters, and also found that high-status perception for a male-in-red was responsible for this effect. Similarly, Roberts, Owen, and Havlicek [22] showed males, as well as females, were judged as more attractive when wearing red or black shirt than when wearing the same shirt of other colours (blue, green, yellow, and white). They revealed these colour effects are due not only to the influence on raters, but also to the influence on wearers (i.e., models). Moreover, Kayser, Elliot, and Feltman [23] demonstrated the red effect on behavioural, not subjective, measures: Men tended to ask more intimate questions to, and sit closer to, a woman in a red shirt than in a green or blue shirt. These colour effects on personal impressions may have a relation to other findings that showed clothing colours are associated with perceived aggression in ball games [24], evaluation of job applicants [25], and performance in combative sports [26] and in team sports (football) [27].

In the present study, after the previous studies mentioned above, the effects of clothing colour (black or red) on personal impressions were examined, but from different points of view. Two distinctive points are highlighted here. First, the colour effects on personal impression as a whole, not limited to the attractiveness as in the previous studies, were targeted by using multiple rating items. Choice of the tested colours, black and red, was derived from the same concern, since these two colours were shown to have almost equivalent effects on the attractiveness judgement [22]. Second, information which participants based to make judgement of one's impression was given by a dialogue between two persons, not by one's face as in most previous studies on this subject. This is because the face is no doubt much stronger as an informative source for estimating one's personality than the

colour of clothing, and to present the face may make a participants' response incline to just a matching-judgement between the face and the colour, which is not of interest here. The dialogue was presented visually as written words so that another influential source of information, one's voice, was concealed. In addition, the impression of colour itself was measured separately and its possible relationship with the estimated personality of the character wearing that colour was explored.

## Methods

### Participants

Forty-one undergraduates (9 males and 32 females) participated. They were divided into two groups as described below. All participants were tested individually.

### Instrument

A laptop computer (Sony PCG-7R1N) was used as the display. It was placed on a desk in front of the participant. An experimental room was illuminated at 500lx by normal fluorescent lamps.

### Stimulus

Microsoft PowerPoint's slide show was presented as a stimulus (Figure 1). It showed written dialogue between two persons in the text boxes. Text boxes were automatically renewed at modest pace as a dialogue proceeded. The slide show also displayed a picture of the upper part of the body (from the neck down to the waistline) sitting side by side.

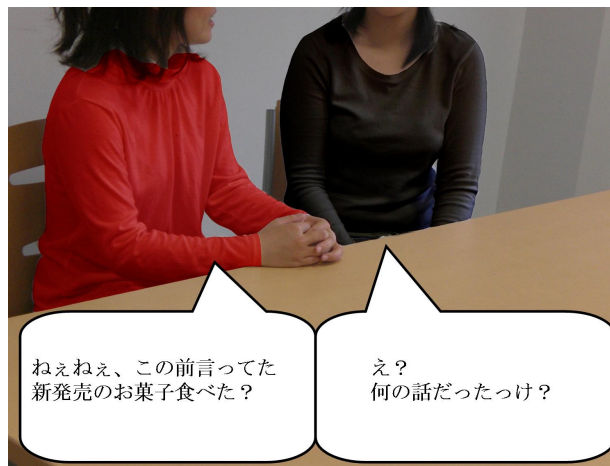


Figure 1: An example of stimulus display.

Two scripts of dialogue were prepared; the ordinary dialogue (O) and the flirtatious dialogue (F). In O dialogue, two girls (A and B) were talking about their favourite cookies and crackers. In F dialogue, a girl (C) talked to her friend (D) about her recent flirtatious affair and D warned C not to do too much. In both dialogues, characters were wearing either black or red clothing. These colours were generated by the colour editing function of the Adobe Photoshop to make two sets of stimulus for each dialogue; A in black / B in red and A in red / B in black for O dialogue, and C in black / D in red and C in red / D in black for F dialogue.

## Procedure

Twenty participants (3 males and 17 females) watched O dialogue with A in black / B in red and F dialogue with C in black / D in red, and another 21 participants (6 males and 15 females) watched them with the colours reversed. After watching each slide show, which lasted for about five minutes, participants were asked to estimate the personality of each character by answering on 22 five-point adjective-pair scales (see Table 1 for the full list of items). The order of presenting two slide shows was randomised among participants. Finally at the end of the experiment, participants were shown black and red squares and asked to judge impression of each colour by answering on 24 five-point adjective-pair scales (see Table 2 for the full list of items). These colours were the brightest part of the clothing shown in the slides; black:  $x = 0.391$ ,  $y = 0.486$ ,  $7.8 \text{ cd/m}^2$ , red:  $x = 0.551$ ,  $y = 0.371$ ,  $13.9 \text{ cd/m}^2$ .

## Results

Personality estimation data was subjected to the factor analysis (maximum likelihood estimation followed by the Promax rotation). Three factors were obtained (Table 1). The first factor highly loaded to the items such as 'steady,' 'reliable,' and 'serious,' and was labelled as *social desirability*. The second factor highly loaded to the items such as 'positive,' 'energetic,' and 'extrovert,' and was labelled as *positiveness*. The third factor highly loaded to the items such as 'pleasant,' 'friendly,' and 'warm,' and was labelled as *friendliness*. Then, mean ratings for the items highly loaded by each factor were calculated for each character (A, B, C, and D) in each participant group (i.e., colour of clothing).

	I: social desirability	II: positiveness	III: friendliness	communality
steady	<b>0.970</b>	0.155	-0.092	0.778
reliable	<b>0.948</b>	0.155	-0.083	0.736
serious	<b>0.910</b>	-0.013	-0.002	0.846
tidy	<b>0.893</b>	-0.018	-0.029	0.828
rational	<b>0.776</b>	-0.152	-0.027	0.796
calm	<b>0.773</b>	-0.151	-0.075	0.813
responsible	<b>0.768</b>	-0.109	0.045	0.702
careful	<b>0.759</b>	-0.187	-0.020	0.812
quiet	<b>0.699</b>	-0.212	-0.027	0.745
kind	<b>0.682</b>	0.181	0.399	0.498
considerate	<b>0.664</b>	0.064	0.371	0.488
acute	<b>0.661</b>	-0.005	-0.169	0.500
positive	0.080	<b>0.954</b>	-0.104	0.716
energetic	0.033	<b>0.836</b>	-0.118	0.568
extrovert	-0.188	<b>0.699</b>	-0.071	0.649
happy	-0.222	<b>0.504</b>	0.181	0.599
cheerful	-0.341	<b>0.462</b>	0.257	0.762
pleasant	0.236	-0.133	<b>0.863</b>	0.681
friendly	-0.098	-0.044	<b>0.726</b>	0.516
warm	-0.094	0.070	<b>0.667</b>	0.535
tender	-0.060	0.016	<b>0.650</b>	0.449
gentle	-0.140	-0.126	<b>0.508</b>	0.218
Eigenvalue	10.786	3.554	1.070	
explained variance (%)	49.029	16.156	4.862	

Table 1: Results of factor analysis (pattern matrix) for the data of personality estimation.

The results are shown in Figure 2. Unpaired *t*-tests showed that the *social desirability* of D was judged to be higher ( $t = 2.06$ ,  $df = 39$ ,  $p < 0.05$ ,  $r = 0.31$ ) when wearing black ( $M = 4.29$ ,  $SD = 0.39$ ) rather than when wearing red ( $M = 4.02$ ,  $SD = 0.45$ ), and the *positiveness* of C was judged to be slightly higher ( $t = -1.71$ ,  $df = 39$ ,  $p < 0.10$ ,  $r = 0.26$ ) when wearing red ( $M = 4.34$ ,  $SD = 0.52$ ) rather than when wearing black ( $M = 4.07$ ,  $SD = 0.50$ ). Any factors of the characters in O dialogue (A and B) were not influenced by the colour of their clothing.

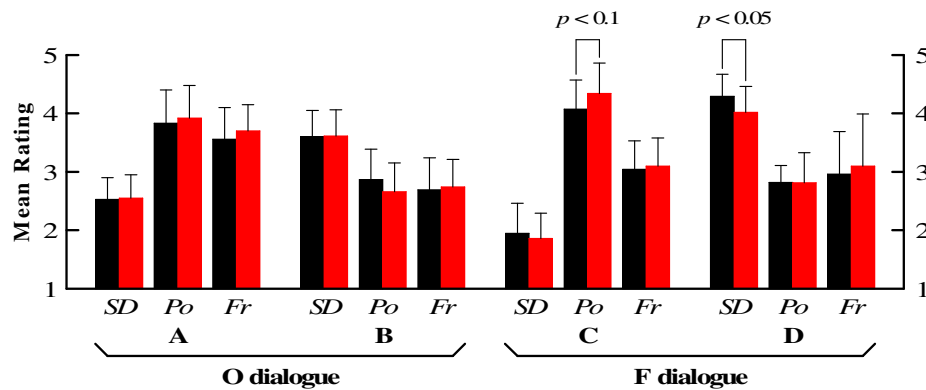


Figure 2: Mean rating for each factor of character A, B, C, and D. Colour of bars indicates the participant group (i.e., colour of clothing worn by each character). Error bars indicate standard deviations. Note, SD: social desirability, Po: positiveness, Fr: friendliness.

	I: calmness	II: comfortableness	III: clearness	communality
calm	<b>1.038</b>	-0.237	-0.049	0.865
steady	<b>0.976</b>	-0.285	-0.036	0.724
quiet	<b>0.947</b>	-0.045	-0.128	0.882
old	<b>0.913</b>	-0.114	0.126	0.732
rational	<b>0.911</b>	-0.070	-0.019	0.767
tidy	<b>0.887</b>	-0.244	-0.065	0.612
dark	<b>0.872</b>	0.105	-0.062	0.887
static	<b>0.869</b>	0.020	0.002	0.774
inactive	<b>0.866</b>	0.085	-0.021	0.844
tired	<b>0.849</b>	0.106	0.048	0.830
plain	<b>0.813</b>	0.171	0.147	0.849
gloomy	<b>0.812</b>	0.221	0.059	0.906
serious	<b>0.734</b>	-0.030	-0.108	0.536
lethargic	<b>0.734</b>	0.241	0.082	0.791
unhappy	<b>0.609</b>	0.329	-0.109	0.731
cold	<b>0.563</b>	0.387	-0.236	0.798
pleasant	0.028	<b>0.765</b>	-0.085	0.628
comfortable	-0.177	<b>0.702</b>	0.080	0.383
beautiful	-0.148	<b>0.694</b>	0.368	0.490
friendly	0.232	<b>0.672</b>	0.058	0.676
clean	-0.344	<b>0.455</b>	0.247	0.203
tender	0.309	<b>0.415</b>	-0.205	0.476
clear	0.641	0.002	<b>0.697</b>	0.839
acute	-0.216	0.111	<b>0.404</b>	0.200
Eigenvalue	13.761	2.411	1.401	
explained variance (%)	57.339	10.046	5.839	

Table 2: Results of factor analysis (pattern matrix) for the data of impression of colours.

Data for the impression of colours was subjected to the same factor analysis. Three factors were obtained (Table 2). The first factor highly loaded to the items such as ‘calm,’ ‘steady,’ and ‘quiet,’ and was labelled as *calmness*. The second factor highly loaded to the items such as ‘pleasant,’ ‘comfortable,’ and ‘beautiful,’ and was labelled as *comfortableness*. The third factor highly loaded to the items such as ‘clear’ and ‘acute,’ and was labelled as *clearness*. Then, mean ratings for the items highly loaded by each factor were calculated for each colour.

The results are shown in Figure 3. Repeated measures analysis of variance showed a significant difference between two colours in *calmness* (black:  $M = 4.07$ ,  $SD = 0.56$ , red:  $M = 2.21$ ,  $SD = 0.75$ ;  $F = 121.27$ ,  $df = 1,40$ ,  $p < 0.001$ ,  $\eta^2 = 0.75$ ) and in *comfortableness* (black:  $M = 2.81$ ,  $SD = 0.54$ , red:  $M = 3.41$ ,  $SD = 0.43$ ;  $F = 34.48$ ,  $df = 1,40$ ,  $p < 0.001$ ,  $\eta^2 = 0.46$ ). *Clearness* did not differ between two colours (black:  $M = 3.48$ ,  $SD = 1.00$ , red:  $M = 3.60$ ,  $SD = 0.78$ ;  $F < 1.0$ ,  $\eta^2 = 0.01$ ).

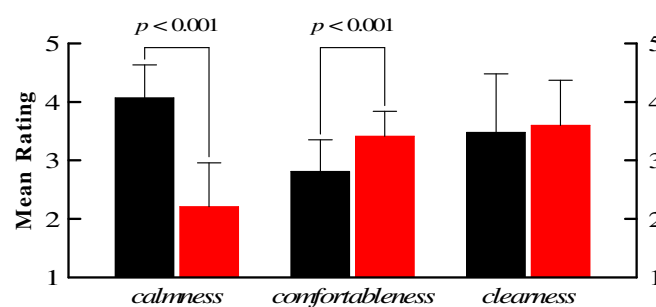


Figure 3: Mean rating for each factor of the impression of colours (black and red). Error bars indicate standard deviations.

Finally, correlation coefficients were obtained among individual scores for three factors of the impression of colour and those for three factors of the personality estimation for each character when wearing the corresponding colour. The results showed that the *calmness* of black correlated positively with the *social desirability* of black-wearing B ( $r = 0.657$ ,  $p < 0.01$ ), while negatively with the *social desirability* of black-wearing C ( $r = -0.765$ ,  $p < 0.001$ ). As for red, on the other hand, its *comfortableness* correlated positively with the *friendliness* of red-wearing A ( $r = 0.566$ ,  $p < 0.01$ ).

## Discussion

It was clearly shown that the colour of clothing influenced an estimated personality of wearer. In contrast with previous studies which mainly focused on the effects on personal attractiveness, the present results showed that the clothing colour could have effects on a more general impression of a person. It is contradictory to Elliot and Niesta’s results that showed positive effects of red on the attractiveness judgement, but not on the overall likeability judgement, for female models [20]. Though speculatively, this discrepancy may be accounted for by the different procedure used in these experiments, especially the way of providing information to be judged; that is, content of a dialogue in the present study and a photographed face in Elliot and Niesta’s study. As for attractiveness, effects should have been less prominent and less explicit in this experiment since the model’s face was not shown to the participants. It should be also noted that the two tested colours, black and red, are shown to have equally positive effects on the attractiveness judgement [22].

Another important finding in this study is the specific condition required for the effects of clothing colour to be manifested. The colour effects were found only in the F dialogue, where persons were engaged in open and frank conversation so that they showed rather distinctive characteristics of themselves; that is, the positive and optimistic character of C and the serious and discreet character of D. The results showed that wearing red clothing increased a *positive* impression of C, whereas wearing black clothing enhanced the perceived *social desirability* of D. However, these effects were not found in the O dialogue, suggesting that the specific colour does not always enhance specific characteristics of, nor add specific impressions to, the person wearing that colour. In other words, the clothing colour should interact with one's original personality that could be judged from other explicit cues (content of a dialogue in the present experiment) to make its potential effects to be manifested. That interaction of the clothing colour with one's original personality in influencing certain aspects of personal impression was also suggested by the results of correlation analysis. As mentioned above, the *calm* impression of black was correlated with black-wearer's *social desirability* positively in B, but negatively in C. Perhaps, a somewhat frivolous and optimistic impression of C interacted inharmoniously with a steady and serious impression of the black colour to produce that negative correlation.

As Elliot *et al.* [28] argued, the colour effects would be context-dependent. For instance, the red colour, which was shown to have positive effects in a relational context (e.g., on the attractiveness judgement for a person) [20-23], can also have negative effects in an achievement context (e.g., on the intellectual test performance) [29,30]. These authors discussed that the red colour carries the meaning of failure and, therefore, evokes avoidance motivation in achievement situations, leading to lower performances. The present results are quite in line with this argument. Clothing colour had, or didn't have, effects on the personal impression, depending on the context, that is content of a dialogue in which characters are depicted.

Finally it should be noted that results of the present study are partly inconsistent with those of the author's previous study that examined the effects of colour lighting. Takahashi [19] showed that the effects of colour lighting on judgement of talkers' emotional expression were found only when the scripts did not include emotional words so that the conversation to be judged was rather unclear and featureless. On the other hand, in the present results, the clothing colour influenced personal impression only in the F dialogue where the character's personality was relatively clear, and could be easily estimated from the content of a dialogue. This inconsistency may be due to difference between the effects of the environmental colour (colour lighting) and the effects of the object's colour (colour of one's clothing). The environmental colour would have effects on the participants' general thinking or judgement by biasing their frame of mind, whereas an object's colour would have more specific effects on the impression of the object to which that colour belongs. In particular, the clothing colour is likely to be directly related to the wearer, becoming a part of him(her)self. It would be able to elicit the impression that, not only *'the person is wearing that colour,'* but also *'he(she) selected or preferred that colour'*. This is, however, no more than speculation at present, and further research that directly compares the effects of the environmental colour and the effects of the object's colour is necessary to make clear distinction between the two types of psychological effects of colours assumed above. In addition, in order to generalise the present findings, future studies should examine the effects of a wider variety of clothing colours on one's impressions judged by more participants ranging over a wider variety of age and socio-cultural groups, since the present experiment investigated only the effects of red and black colours using only Japanese university students as the participants. In particular, the attributes of participants would considerably influence the results through their particular association of colours, conventional use of colours, and colour preferences.

## Conclusions

The present study added new evidence to the research on clothing colour effects on one's impression; a wearer's particular impression, not limited to his(her) attractiveness, was shown to be influenced by the clothing colour. Specifically, the red clothing enhanced a positive impression of an optimistic character, and the black clothing enhanced the perceived social desirability of a discreet character. When a wearer didn't exhibit any particular characteristics, on the other hand, the clothing colour effects were not shown, suggesting that these effects are context-dependent; the effects of clothing colour would be manifested by interacting with one's original personality that could be judged from other explicit cues. It was also suggested that the environmental colour (e.g., colour lighting) and the object's colour (e.g., colour of one's clothing) would be different in ways they exert psychological effects on us.

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