Colour and emotion: an intercultural approach

L. Oberascher, F. Oberascher and M. Gallmetzer
Kaltnergasse 8, 5020 Salzburg, Austria, Europa
Corresponding author: L. Oberascher (ecd@leoncolor.com)

ABSTRACT

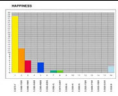
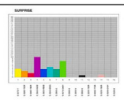
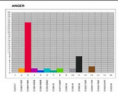
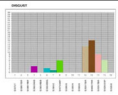
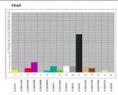
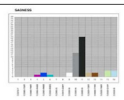
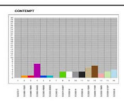
Referring to Ekman's universality (interculturality) theory of emotions, we have compared the emotion/colour-coding of Europeans and Africans. The test-persons were asked to assign one or more out of a total number of 16 NCS colour samples to the seven presumably basic emotions pleasure, surprise, anger, fear, disgust, sadness, contempt (presented as verbal concepts). We also looked at the colour coding differences among the emotions within the groups. For both types of comparisons we found some striking differences. Furthermore we found that black, red, white and yellow seem to be the colours primarily used in emotion/colour-coding.

1. INTRODUCTION

In our paper[1] for the AIC-Congress in Bangkok 2003 we focused on the question how far the postulated universality of emotions (as by Ekman's[2] "neurocultural" theory) could be applied to the relationship between emotion and colour.

In our first empirical approach we used different methods (1. assignment of colour concepts to basic emotion pictures, 2. assignment of colour samples to basic emotion concepts, 3. representation of basic emotion concepts in colour compositions) to test a total of more than 70 Europeans on how they would represent in colour (single colours, colour combinations or free colour designs) the seven basic emotions pleasure, surprise, anger, fear, disgust, sadness, contempt. The results of these emotion/colour-coding studies showed a high concurrence (see table 1).

Table 1: Comparison of absolute colour choices (concept, sample, composition) between 3 different studies[1].

		1) colour concepts		2) colour samples		3) colour compositions		4) histograms	5) chromograms	
			n = 13*		n = 43**		n = 16	ad 2	ad 3	ad 3
	PLEASURE	yellow (bright-) orange green (light-) ------- ------- -------	10/23 (43%) 06/23 (26%) 03/23 (13%) ------- ------- -------	S 0570-Y, yellow S 0580-Y50R, orange ------- S 0580-Y90R, red S 2565-R80B, blue S 0570-Y + S 0580-Y50R	(28/56) (12/56) ------- (06/56) (05/56) (04/56)	yellow orange ------- red -------	(16/16) (06/16) ------- (05/16) -------			
	SURPRISE	yellow (neon-, bright-) white blue (whitish) green (whitish, light) ------- ------- -------	05/21 (24%) 04/21 (19%) 04/21 (19%) 04/21 (19%) ------- ------- -------	------- ------- ------- S 0575-G40Y, yellowish green S 2565-G, green S 2555-B30G, turquoise S 2060-R40B, purple	------- ------- (08/42) (04/42) (05/42) (10/42)	yellow white blue yellowish green ------- light turquoise -------	(10/16) (05/16) (08/16) (07/16) ------- (07/16) -------			
	ANGER	red (fiery) black -------	11/20 (55%) 02/20 (10%) -------	S 0580-Y90R, red S 9500-N, black S 6030-Y70R, brown	(25/48) (08/48) (03/48)	red black -------	(16/16) (11/16) -------			
	DISGUST	green (olive-, bilious-, neon-) ------- brown (dirty-) ------- pink	06/20 (30%) ------- 04/20 (20%) ------- 03/20 (15%)	S 0575-G40Y, yellowish green S 0520-G10Y, whitish green S 6030-Y70R, brown S 2020-Y30R, beige S 0520-Y90R, pink	(06/56) (06/56) (16/56) (13/56) (09/56)	(yellowish)olivegreen yellowish green brown ------- (pinkish)purple	(11/16) (7/16) (10/16) ------- (04/16)			
	FEAR	yellow (alarming-) red (purple-) black purple ------- -------	03/16 (19%) 02/16 (13%) 02/16 (13%) 02/16 (13%) ------- -------	------- ------- S 9500-N, black S 2060-R40B, purple S 0500-N, white S 3500-N, grey	------- ------- (19/44) (05/44) (03/44) (03/44)	------- red black purple ------- grey	------- (10/16) (08/16) (05/16) ------- (07/16)			
	SADNESS	grey black purple (deep-) -------	05/23 (22%) 04/23 (18%) 03/23 (13%) -------	S 3500-N, grey S 9500-N, black ------- S 0530-B, whitish blue	(12/48) (20/48) ------- (03/48)	grey black ------- -------	(11/16) (15/16) ------- -------			
	CONTEMPT	blue (royal-, strong-, bright-) brown black green (light-, turquoise-) ------- ------- -------	10/21 (48%) 02/21 (10%) 02/21 (10%) 02/21 (10%) ------- ------- -------	S 0530-B, whitish blue S 6030-Y70R, brown ------- ------- S 2060-R40B, purple S 2020-Y30R, beige -------	(04/40) (06/40) ------- ------- (07/40) (05/40) -------	blue ------- ------- ------- purple ------- grey	(07/16) ------- ------- ------- (07/16) ------- (07/16)			

* number of responses 16 to 23, ** number of responses 40 to 56,

This paper focuses on exploring the question whether emotion/colour-coding is a universal, intercultural phenomenon. For that purpose we asked 49 persons of African origin to assign the 16 NCS colour samples to the seven basic emotions (presented as verbal concepts!). This test-group is composed of two subgroups: 19 so-called 'Afro-Europeans' who have lived in Europe for at least 10 years, and 30 citizens of West-Africa (Sierra Leone, Gambia) who live and have been interviewed there. The results of the tests with the two sub-groups as well as the results of our previous study with Germans and Austrians have been statistically analysed, first with a focus on the emotional differences within the respective groups, second with a focus on the differences between the groups.

In addition to that we compared how frequently the groups assigned the different colours to the seven emotions, thus looking at which colours are primarily used in emotion/colour-coding.

2. METHOD

The test-persons were divided into four groups: group 1 (30 West Africans); group 2 (19 Afro-Europeans); group 3 (combined results for groups 1 and 2); group 4 (the 43 Austrians and Germans of our previous study). As in our original study, the two African sub-groups were given a fairly free choice when assigning the 16 NCS colour samples (format A16) 1. S 0570-Y, 2. S0580-Y50R, 3. S 0580-Y90R, 4. S 2060-R40B, 5. S 2565-R80B, 6. S 2555-B30G, 7. S 2565-G, 8. S 0575-G40Y, 9. S 0500-N, 10. S 3500-N, 11. S 9500-N, 12. S 2020-Y30R, 13. S 6030-Y70R, 14. S 0520-Y90R, 15. S 0520-G10Y, 16. S 0530-B to the seven basic emotions: to each emotion term the test-persons could assign several individual colour samples as well as combinations of colour samples or no colour sample at all. In addition to that we asked for the test-persons' comments on the colour samples. All this was done in terms of conducting a pilot study that allows a broad approach to the topic and may initiate interesting questions as well as further research.

All 3 groups were interviewed in daylight, though of course at different times and different places. All test-persons described themselves as having full colour vision. We did not conduct any colour discrimination test. However, standardising the test conditions could enhance the reliability and validity of the results for future research. On the other hand, the 16 colour samples used in the tests consisted of easily discernible colours that can be characterised as being prototypical. All test-groups varied well in terms of sex, age (average of 40) and profession.

The tests on emotion/colour-coding were analysed with a focus on the following two aspects: (1) compairing pairs (e.g. pleasure vs. fear) within each group and (2) between the different groups. For that purpose we gathered the following data: on the one hand we calculated the total numbers of all colour-codings assigned to the individual emotions (top ranks plus further ranks for single colours as well as for colour combinations), on the other hand we calculated only the top ranks for single colours or combinations. In our previous study we ranked all colours named in a colour combination as if they were individually named in the colour-coding process. In the present study, for which the data of our previous study had been further processed, we only counted the first colour named in a colour combination, so that every emotion/colour-coding gets calculated with only one colour in the first rank. This guarantees that additional colours named in colour combinations cannot influence any statistically significant frequencies of single colours and that the total number of first ranks is limited with the sample size. This decision may seem sensible for analytical and methodological reasons. However, it remains to be investigated, whether the naming of a particular colour as the first within a combination reflects a deliberate choice of this colour as being "most characteristic" for a particular emotion, or whether it has been named first for other reasons (e.g. by chance).

In order to analyse our emotion/colour-coding data statistically we transformed the NCS colour codes into CIELAB values. We compared the individual basic emotions as well as the different cultural groups by employing a t-test (2 tails, type 2) assuming that if a distribution differs from another at least in one of the 3 dimensions L* a* b*, it can be considered significantly different. In some cases we also applied a two-dimensional analyses (Mahalanobis distance) to the data in order to achieve more accurate results. This was done especially in cases where the p-value of the t-test was getting very close to becoming significant and where such significant differences could be assumed to occur. (For highly precise analyses however a 3-dimensional comparison would be necessary.)

As comparisons between pairs of emotion/colour-codings within the groups are sample dependent, we analysed the data in light of their split half reliability.

In addition to that, we analysed each test-person's intrasubjective colour-coding differences for emotion pairs by calculating the differences in the 3 CIE-dimensions and testing them for statistic significance (through 1-dimensional t-tests).

(3) In order to compare which colours were used most frequently by the different groups we added up the colour-codings for all emotions for each group, worked out each colour's percentage and ranked the colours correspondingly. This calculation was also done for group 3 (groups 1 + 2) as well as for all groups taken together in order to support a strong claim about the "most important" colours, at least as far as emotion-coding within the scope of this study is concerned.

3. RESULTS

(1) The emotion/colour-codings within the groups revealed the following: Most differences occur within group 4 (Central-Europeans; comparisons of 18 out of 21 possible emotion pairs reveal at least one significant difference for at least one dimension): a difference exists between all emotions except for fear vs. sadness, surprise vs. contempt and surprise vs. disgust. The latter result – viewed in direct comparison with the colour-distribution-histograms for disgust vs. surprise – seems to be a methodological artefact, since both emotions here exhibit major differences in the attribution of colours: while beige, brown and pink dominate for disgust, surprise is accompanied by shades of yellow to red and violet to blue; within the CIE-values, however, these two groups of colours approximate each other to such an extent that a unidimensional comparison of isolated L* a* b* values cannot reveal any "phenomenological" difference.

Group 1 (West-Africans) does not contain such striking differences (12 out of 21): pleasure differs from surprise, anger, disgust, fear, sadness; surprise from pleasure, sadness, contempt; anger from pleasure, sadness, contempt; disgust from pleasure, fear, contempt; fear from pleasure, disgust, contempt; sadness from pleasure, surprise, anger; contempt from surprise, anger, disgust, fear.
Group 2 (Afro-Europeans) reveals differences in the comparisons of 15 out of 21 emotional pairs: pleasure differs from all other emotions; surprise from pleasure, fear, sadness; anger from pleasure, surprise, sadness, contempt; disgust from pleasure, fear, sadness; fear, from pleasure, surprise, disgust, contempt; sadness from pleasure, surprise, anger, disgust, contempt.

(2) Concerning the comparisons of pairs of groups (see table 2) the following main differences for emotion/colour-codings were established in the t-tests and by use of Mahanalobis distance:

	G1 vs. G2			G1 vs. G4			G2 vs. G4		
	L	a	b	L	a	b	L	a	b
pleasure		*				***		*	***
surprise	*	**			**				
anger				La, **				**	
disgust				La,*	Lb,*				
fear	*		*		**	*		*	
sadness	**				*	*		*	
contempt						*	**		**

Table 2: Group 1 and 4 exhibit a significant difference (including the results of the Mahalanobis-test for G1 vs. G4, anger and disgust) for all emotions in at least one L* a *b* dimension or plane of La, Lb or ab. Group 1 and 2 differ only with regard to pleasure, surprise, fear and sadness; Group 2 and 4 differ with regard to pleasure, anger, fear, sadness and contempt.

The most dominant differences in emotion/colour-coding can therefore be found between West-Africans and Central-Europeans, further within Central-Europeans and Afro-Europeans, while the latter and the West-Africans differ least from each other. In fact, it seems that the Afro-Europeans adopt an intermediate cultural position in their emotion/colour-codings.

The differences in the test-person's intrasubjective colour-coding differences for emotion pairs are highly significant throughout. Of course these differences need not necessarily be established for all sample comparisons, as opposite codings of a sample's elements may counterbalance each other and neutralise any differences.

(3) Concerning the "most important", most frequently used colours in emotion/colour-coding the following interesting picture emerges: both in group 1 as well as group 2, the most frequently assigned colours come from the "classic" colour-triad black, white, red. In group 1 the most frequent colours are red (22%), black (17%) and white (15%), in group 2 black (24%), red (19%) and white (14%); in both groups the fourth position is taken by yellow with 10% of all assignments. In group 4,

on the other hand, the frequency list is headed by black (17%), yellow (12%), red (10%) and violet (9%); white (3%) only comes in position 14. Insignificantly, the results for group 3 are very similar to those of groups 1 and 2, though they reflect the frequencies established for group 1: red (21%), black (20%), white (14%) and yellow (10%). Adding up all group results the list is headed by black (18%), red (15%), yellow (11%) and white (9%); here the results for yellow and white are influenced by the results for group 4, so that the dominance of the colour-triad black, white, red seems in fact to be restricted to the Africans. The t-test confirms the differences between the groups, dimension a* being significantly different between group 1 and group 4, group 3 (1+2) and group 4, as well as group 1 and groups 2+4.

4. CONCLUSIONS

Building up on our 2003 study on emotion/colour-coding the present study foregrounds intercultural comparisons of different emotion/colour-coding habits in (West-) Africa and (Central-) Europe. For most of the analysed emotion pairs clear differences could be shown to exist within and between the cultural groups. The Afro-Europeans indeed seem to take up an intermediate position (they differ from the other two groups to a lesser extent than those differ from each other).

The following intercultural emotion/colour-codings emerged in the study: (1) pleasure - yellow, white. (2) surprise - ambivalent: while Central- and Afro-Europeans assign rather "positive" colours to these emotions, the West-Africans prefer red and sometimes also black; the test-persons' comments on their colour-codings hint at the fact that surprise in this case is interpreted negatively as threat, danger or disturbance, which explains the similarities to the colour-codings for fear. (3) anger - red, black. (4) disgust - very inconsistent results. (5) fear - black, red, particularly the West-Africans also name white thereby assigning the classic, archaic colour-triad. (6) sadness - achromatic colours (black, grey, white). (7) contempt - like disgust very inconsistent. As a result, the emotions do not only seem to differ in respect of their assigned colours but also in respect of a clear, consistent representation through colours: especially pleasure, anger, fear and sadness exhibit fairly clear colour-profiles with a strong component of at least one single colour. We assume that the analysis of larger sample sizes will substantiate these tendencies shown for emotion/colour-coding. In our analysis of general colour frequencies the colours of the "classic colour-triad" - black, white and red - have emerged as the preferred emotion coding colours.

In one case the test-person (in group G1) codes sadness as yellow. This unusual colour-coding is, however, explained in the person's comments: yellow was the most prominent colour in connection with a personal tragedy (“It reminds me of the day may relationship got broken. My partner had this colour on this day.”). This gives rise to the question whether colour-codings are indeed motivated by "archetypal" sensations, cultural conventions, individual (biographic-anecdotal) associations or by personal preferences/aversions. In the light of Ekman's universality hypothesis our study is grounded on the first assumption - which, however, remains to be validated through further research.

Acknowledgement

Our special thanks to Dr. Osvaldo da Pos for his valuable advice, comments and personal assistance.

References

1. L. Oberascher and M. Gallmetzer, “Colour and emotion”, in Proceedings of the 11th Congress of the International Colour Association (AIC-Color 03) (Bangkok, Thailand, 2003) pp. 370-74.
2. P. Ekman and R. J. Davidson (Ed.), *The nature of emotion* (Oxford University Press, New York, 1994).