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Colour-word associations: University undergraduate prospectus as a case study

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ABSTRACT

Colour plays an important role in conveying meaning and is today ubiquitous in all forms of visual communication, yet little is known about the relationship between semantic networks and colours. The study's objective was to analyse word-colour associations to evaluate their consensus from which a structure would emerge. One hundred and forty-five words were selected from a University undergraduate prospectus and nine colour samples evenly distributed on the colour wheel were used. Eighty-five undergraduate students were asked to indicate which of the nine colours they most associate with each of the 145 key words. A correspondence analysis revealed a three-dimensional structure accounting for 78% of the variance. The two first dimensions provided a triangular arrangement associating colours to semantic categories with green associated to natural environment, red and blue to professional responsibilities and yellow and pink to youth and creativity.

Keywords: colour-word association, colour symbolism, correspondence analysis.

INTRODUCTION

In cognitive science, colour is considered as a visual elementary feature just like shape, movement, depth, orientation or contrast. These features are processed automatically at a pre-attentive stage corresponding to an early stage in the visual system [1]. Yet, compared to the other elementary features, colour has an immediate perceptual, cognitive and emotional significance in human experience [2] and a powerful symbolic function. Archeological finds in southeast Spain dating from 115,000 years ago, show that red and yellow ochres were included in complex colourant mixtures that are accepted by the scientific community as proxies for symbolic behaviours [3].

Hence, together with the development of the most elaborated system, i.e., the articulate language, colour symbolism is at the roots of human symbolic behaviour.

It is therefore not surprising that today in laboratory conditions participants find quite natural to associate words to colours. Providing eight NSC colour samples sampling the entire colour wheel, in a free association task, Indian participants were asked to write as many words they could associate to a given colour in 60 seconds [4]. Based on the semantic word categories, three types of association were identified: colours associated to natural objects that maintain relation of physical similarity with their referent (green-grass, red-fire etc..) colours associated to concepts that maintain relation of conventionality defined by a given cultural consensus (red-power; orange-puja inspiration etc..) and words associated with man-made objects that are also conventional relationships with possibly a more restricted consensus limited to sub-cultures (denim-blue).

Conventional as opposed to physical relationship change with the culture, this change is well known of the marketers. For instance, global marketers are aware in branding products that in China the colour grey is associated with 'inexpensive' while in US it is associated with 'expensive'. On the other hand, the colour brown in China is associated with 'good-tasting' and in US with 'inexpensive' [5]. The way colours acquire a given conventional relationship with their referent will need a meticulous investigation of the history of its cultural determinants. For the present study, the research question was limited to test whether in a well-defined social context of university undergraduate students conventional relationships are naturally present by examining colour associations that students make with words extracted from their undergraduate prospectus. If conventional relationships exist they will be based on word-colour association consensus.

EXPERIMENTAL

Participants: A convenience sample of 85 participants, 72 females (mean age = 20.75, SD = 3.42) and 13 males (mean age= 21.15, SD = 2.27) studying Psychology (N=29); Fashion Media and Marketing (N=10); Event Management (N=36); Business Management (N=6); Drama and Event Management (N=3) and English Language (N=1). The experiment was approved by the University of Winchester Ethic Board.

Material and procedure: The response sheet consisted in 9 coloured rectangles and a list of 145 words (see Figure 1). Colours were selected from the NCS colour wheel (four cardinal colours + purple and 4 intermediate colours) and the closest visual match with sample from the Pantone fan deck was used for printing. Words were collected from the University of Winchester 2015-16 undergraduate prospectus which included 51,502 tokens (all word occurrences) from which 3930 types (i.e., word) were extracted leading to a final selection of 145 words based the word frequency and their relevance concerning the University activities and values. Students were invited to fill out the response sheets at their own pace after their usual lecture.

Figure 1: Three first items of the word-colour association response sheet.

RESULTS AND DISCUSSION

A frequency table with a total of 12,139 (186 missing data) data points provided an initial picture of the word-colour associations. The overall frequency selection for each colour and the word-colour associations selected by more than 40% of the respondents are reported in table 1. Dark-blue is the most frequently selected colour, followed by yellow, red, orange, purple, light blue, dark green, pink and light green. 'Youth', 'young' and 'children' are most frequently associated with yellow. 'Professional', 'master degree', 'industry', 'finance', 'enterprise', 'entrepreneurship', 'employment', 'business management', 'business' and 'accounting' are most frequently associated with dark-blue. 'Geography', 'field trips', 'field work' and 'environment' are most frequently associated with dark green. 'Fashion', 'dance' and 'choreography' are most frequently associated with pink and 'criminology', 'America' and 'impact' with red. Finally, 'creative writing' is most frequently associated with orange and 'knowledge' with purple. Light green and light blue do not exhibit any particularly high frequency of associations. Although the unbalanced male/female ratio (1/5.5) suggests caution in interpreting these data, gender differences were noted in case of 'creative writing-orange' and 'knowledge-purple' where high frequency selections were exclusively observed in men. Likewise, 'master degree', 'finance' and 'industry' were more frequently associated with red in men than with dark-blue as it was for women.

To further investigate the relationship between the two nominal variables 'words' and 'colours' a correspondence analysis (CA) was carried out. The analysis indicated that three dimensions could account for 78% of the variance with a significant relationship between the two variables (chi-square (1152) = 5862, p<0.001). Dimension 1 (D1) accounted for 35% of the variance opposing dark-green to pink while dimension 2 (D2) accounting for 28% singled out red and dark blue. The third dimension (D3) accounting for 12% of the variance (not shown) dissociated pink from yellow. When both words and colours are plotted on a biplot (Figure 2), words clustered on the green pole correspond to 'environment', 'field trips', 'fieldwork', 'geography' and 'sustainable' and words clustered on the pink pole are 'dance', 'fashion', 'young/youth/children', 'unique', 'creative/creativity', 'friendly', 'choreography', semantic categories for this dimension could be identified as 'natural environment' vs 'youth and creativity'.

Along the second dimension, words are clustered around red and blue colours. These include 'America', 'business', 'finance', 'employment', 'work', 'graduation'. The word cluster at the other side of the dimension is not clearly organised around a colour and correspond to 'peace', 'spirituality', 'freedom' and 'volunteering'. Semantic categories for D2 could be described as 'professional responsibilities' versus 'ethical values'. The third dimension (not shown) opposes yellow to pink and dissociates orange from purple. Words clustered around pink correspond to 'choreography', 'performance', 'desirable', 'gender' and 'dance' and those clustered around yellow correspond to 'children/youth/young', 'christian', 'christian foundation' and 'spirituality'. The semantic categories could be described as 'performing art' and 'youth and spirituality - ethical values'.

Table 1: Overall frequency selection (in percentage) for each colour and word-colour associations selected by more than 40% for females (f) and males (m). Colour code: Frequencies below 11% (which correspond to the frequency if colours are randomly selected) are coded in blue tint, and high frequencies in red tint.

|		dark blue	dark green	light blue	light green	orange	pink	purple	red	yellow
Total (%)		**16.4**	**8.4**	**9.5**	**6.4**	**10.8**	**8.3**	**10.6**	**13.9**	**14.1**
young	f	1.39	0.00	5.56	11.11	6.94	13.89	5.56	5.56	50.00
	m	0.00	15.38	15.38	0.00	15.38	7.69	0.00	7.69	38.46
youth	f	1.39	1.39	6.94	8.33	22.22	13.89	2.78	2.78	40.28
	m	7.69	7.69	7.69	7.69	7.69	7.69	0.00	15.38	38.46
children	f	4.17	2.78	4.17	5.56	18.06	9.72	2.78	1.39	51.39
	m	23.08	15.38	0.00	7.69	15.38	7.69	0.00	7.69	23.08
professional	f	45.83	2.78	5.56	2.78	1.39	1.39	12.50	19.44	4.17
	m	23.08	0.00	23.08	0.00	0.00	15.38	7.69	23.08	0.00
masters degrees	f	47.22	4.17	6.94	2.78	4.17	2.78	6.94	13.89	11.11
	m	15.38	7.69	15.38	0.00	0.00	7.69	15.38	23.08	15.38
industry	f	55.56	5.56	6.94	0.00	8.33	0.00	4.17	8.33	9.72
	m	15.38	15.38	7.69	7.69	0.00	15.38	0.00	38.46	0.00
finance	f	45.83	9.72	2.78	1.39	4.17	1.39	6.94	19.44	5.56
	m	7.69	0.00	23.08	0.00	0.00	15.38	23.08	30.77	0.00
enterprise	f	19.44	8.33	9.72	6.94	15.28	4.17	8.33	5.56	22.22
	m	53.85	0.00	0.00	0.00	7.69	0.00	0.00	23.08	15.38
entrepreneurship	f	23.61	12.50	8.33	8.33	9.72	2.78	15.28	11.11	8.33
	m	46.15	15.38	0.00	0.00	7.69	0.00	15.38	7.69	7.69
employment	f	40.28	9.72	5.56	1.39	9.72	1.39	6.94	13.89	6.94
	m	30.77	0.00	7.69	7.69	7.69	7.69	7.69	23.08	7.69
business management	f	51.39	4.17	11.11	1.39	6.94	5.56	2.78	12.50	4.17
	m	46.15	0.00	15.38	0.00	0.00	0.00	15.38	23.08	0.00
business	f	47.22	2.78	6.94	0.00	9.72	5.56	6.94	18.06	2.78
	m	30.77	0.00	15.38	15.38	7.69	7.69	0.00	23.08	0.00
accounting	f	47.95	10.96	10.96	2.74	2.74	2.74	0.00	15.07	5.48
	m	23.08	0.00	30.77	7.69	0.00	7.69	15.38	15.38	0.00
geography	f	5.56	59.72	2.78	13.89	1.39	2.78	2.78	5.56	2.78
	m	0.00	46.15	7.69	0.00	7.69	7.69	0.0%	15.38	15.38
field trips	f	1.39	54.17	5.56	27.78	1.39	1.39	0.00	1.39	6.94
	m	0.00	53.85	0.00	15.38	7.69	0.00	7.69	7.69	7.69
fieldwork	f	8.33	48.61	2.78	27.78	4.17	0.00	0.00	2.78	4.17
	m	15.38	38.46	0.00	23.08	7.69	0.00	7.69	7.69	0.00
environment	f	2.78	50.00	5.56	29.17	4.17	0.00	0.00	1.39	2.78
	m	7.69	46.15	7.69	15.38	0.00	0.00	7.69	0.00	7.69
fashion	f	4.11	2.74	1.37	2.74	1.37	53.42	21.92	9.59	2.74
	m	7.69	0.00	7.69	0.00	0.00	38.46	15.38	23.08	7.69
dance	f	2.78	0.00	4.17	2.78	8.33	33.33	26.39	2.78	18.06
	m	0.00	7.69	7.69	0.00	7.69	61.54	7.69	0.00	7.69
choreography	f	5.56	0.00	6.94	2.78	8.33	22.22	23.61	8.33	19.44
	m	0.00	7.69	15.38	0.00	15.38	46.15	7.69	0.00	7.69
criminology	f	19.44	2.78	2.78	1.39	12.50	2.78	6.94	47.22	4.17
	m	7.69	7.69	15.38	0.00	7.69	7.69	15.38	38.46	0.00
America	f	9.59	1.37	6.85	1.37	0.00	0.00	1.37	73.97	5.48
	m	15.38	0.00	38.46	0.00	0.00	0.00	0.00	46.15	0.00
impact	f	15.28	9.72	5.56	2.78	12.50	5.56	15.28	23.61	8.33
	m	0.00	0.00	0.00	7.69	0.00	15.38	7.69	69.23	0.00
creative writing	f	4.17	4.17	6.94	4.17	20.83	15.28	9.72	12.50	18.06
	m	0.00	0.00	15.38	0.00	53.85	0.00	7.69	7.69	15.38
knowledge	f	27.78	6.94	2.78	4.17	5.56	2.78	12.50	19.44	13.89
	m	7.69	0.00	15.38	0.00	7.69	0.00	46.15	15.38	7.69
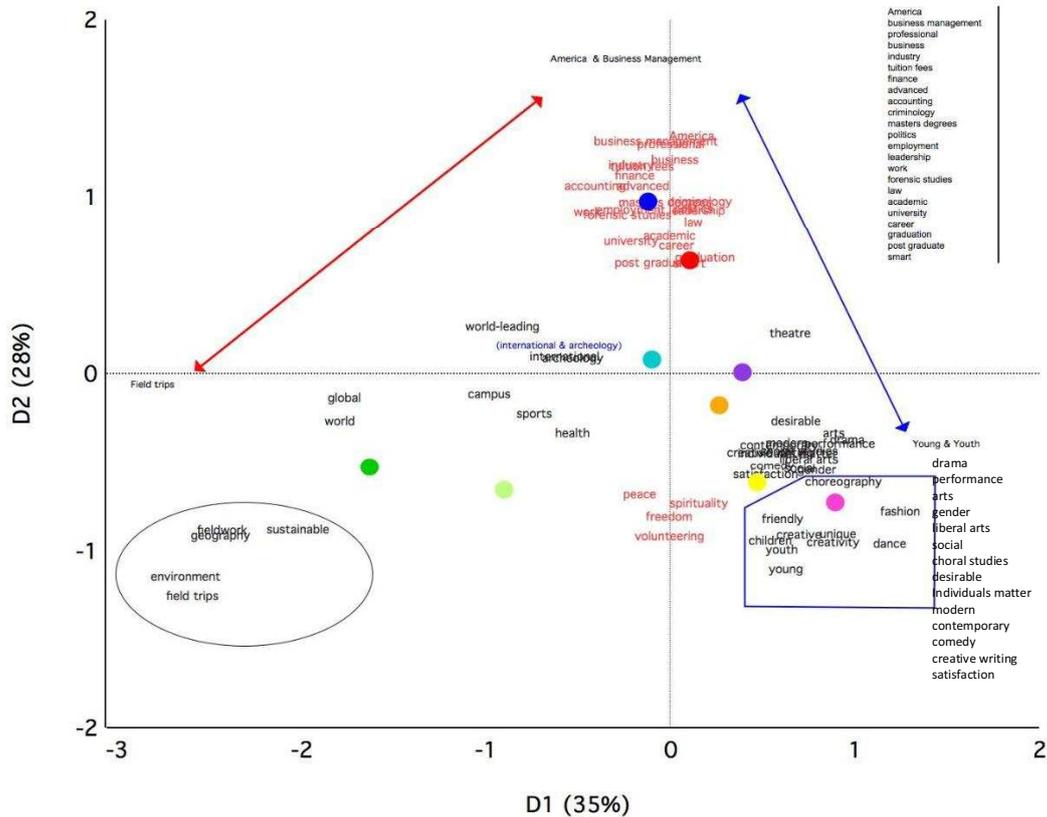
Figure 2: Biplot representing the two first dimensions with word-colour associations. Words and colour proximities reflect the strength of their associations. Words in tight cluster are listed onside for legibility.

CONCLUSIONS

Consensus obtained in word-colour associations revealed an underlying structure for which words in the two first dimensions clustered around three colour poles of 'green', 'red and blue' and 'yellow and pink'. These poles were associated to three semantic categories described as 'natural environment', 'professional responsibilities' and 'youth and creativity'. A fourth semantic category identified as 'ethical values' was not clearly associated to a colour and a third dimension point towards a distinction between 'performing art' and 'youth and spirituality / ethical values'. The emergence of a structure is indicative of shared word-colour associations in a given corpus of words, here a University undergraduate prospectus. These associations are prone to change with context [6], but possibly present in any socio-cultural environments reflecting the fact that colour-meaning emerges from intersubjectivity and cultural sharing.

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