Differences in Color Naming between British and American English Speakers

Dimitris Mylonas [a*], Lindsay W. MacDonald [b], Lewis D. Griffin [a]

[a] *Department of Computer Science, University College London, UNITED KINGDOM*

[b] *Faculty of Engineering Sciences, University College London, UNITED KINGDOM*

**d.mylonas@ucl.ac.uk*

ABSTRACT

In an ongoing web-based color naming experiment (available at: www.colornaming.com), a large number of British (n=525) and American (n=525) participants with normal colour vision responded with names for 600 color stimuli. We examined differences in color naming between American and British English speakers and the agreement between their easy and hard to name colors as measured by the entropy of the distribution of the responses to each stimulus. British English speakers displayed a richer color vocabulary than American English speakers (number of distinct terms 2094 vs 1653), but the Americans named colors 10% faster than the British. A comparison of the centroids in CIE *L*a*b** coordinates for the eleven basic color terms (BCTs) produced an excellent agreement (mean ΔE_{00}=1.3) between the two groups of speakers, with the largest difference (ΔE_{00}=2.7) for blue. Across stimuli, the degree of ambiguity in color naming was correlated between languages (R=0.55). British and American English speakers appear to be more united than divided by a common color language but differences do exist.

KEYWORDS: color naming, British English, American English

INTRODUCTION

The playwright George Bernard Shaw famously said that "Britain and America are two nations divided by a common language". Many differences are obvious in descriptors ('pavement' vs 'sidewalk') and spelling ('manoeuvre' vs 'maneuver') and pronunciation ('tom-arto' vs 'toe-mayto'), but could there also be differences in the way that people in Britain and the USA use color names?

Previous research in colour naming involving a small number of American English speakers (N_A=1+6) [1] and British English speakers (N_B=20) [2] constrained their responses to single word descriptions. The experiments took place in controlled laboratory conditions but the different sampling and illumination used in each study may have influenced their in-between relatively large colour differences (mean ΔE_{00} = 7.4) between the centroids of the eleven basic color terms (white, black, red, green, yellow, blue, brown, purple, pink, orange, gray) [3] and make direct comparisons difficult. In addition, a previous study showed that speakers can use at least 30 colour names in their native language without training [4].

In this study, we explore similarities and differences in colour naming between a larger number of British (N_B=525) and American (N_A=525) English speakers with normal color vision for the top-thirty ranked names using an unconstrained experiment conducted on the Internet [5].

EXPERIMENTAL

We designed an online multilingual color naming experiment to collect broad datasets of color names from a large number of observers from linguistically and demographically diverse populations [4]. Over the past eight years, the experiment has been translated into 22 languages and has gathered responses from many thousands of observers. In this study, we analyzed 12,000 raw responses from British (N_B=600) and 12,000 from American (N_A=600) English speaking participants.

At the beginning of the experimental procedure, we ask each observer to adjust his/her display to sRGB settings using an advanced or basic set of instructions and the brightness of the monitor to make visible all 21 steps of a grey scale ramp. We also screen all observers for possible color deficiencies with a web-based Dynamic Colour Vision Test and we considered only responses from observers with normal trichromatic vision (British: 90% vs American 88%).

In the unconstrained color-naming task, each participant is presented with a sequence of 20 colors randomly selected from 600 total samples in the Munsell Renotation Dataset. Following the suggestions of Billmeyer [cf. 2], the 600 samples were chosen as an approximately uniformly distributed array from a variable number of hues at different Munsell value and chroma. Color stimuli were specified in sRGB and presented against a neutral mid-gray background. Stimulus size (width by height) on the display was 147 by 94 pixels, which for a display resolution of 3.3 pixels per mm (83 pixels per inch) would be 45 by 30 mm, subtending an angle of approximately 5 by 3.4 degrees at a viewing distance of 50 cm. Response times were measured from the onset of the stimulus to the subject's first keystroke of the typed color name. The web interface also includes two questionnaires to collect information about the viewing conditions, display properties and cultural background of each participant.

We corrected any spelling mistakes found in the raw data. Words that were hyphenated, comma-separated, and in parentheses were treated as multi-word color names. We rejected responses that involved incomplete or numerical terms or words written in non-English alphabets. The above filtering resulted in a dataset from 543 British and 525 American participants. We ensured an equal split between the two groups by random exclusion of British participants' data beyond the number of Americans (N_B=525 for British and N_A=525 for Americans).

RESULTS AND DISCUSSION

The occurrence of color discriptors with varying word number for British English speakers was: monolexemic non-basic color terms 26%; monolexemic basic color terms 30%; color terms with one modifier 39%; color names containing ≥ 3 words 5%. In contrast, American English speakers produced more monolexemic non-basic color terms 31%; equal number of monolexemic basic color terms 30% and fewer color names containing two words 34% or containing 3 words or more 4% than British English speakers.

British produced a richer color vocabulary than Americans (N_B=2094 vs N_A=1653 distinct color discriptors). The thirty most frequent color names are shown in Figure 1. The rankings of the first five terms purple, pink, blue, green and brown were similar between British and Americans, but notable differences were found for lilac, grey, magenta, teal and salmon. Lilac was ranked sixth for British and twenty-second for Americans. Americans used often the term lavender (14th) to denotate a similar color category to lilac but for British lavender was ranked in fourty-fifth position. British used more often grey (9th) than Americans (26th) but American used more often the spelling gray to name the same category (34th) while British used rarely this spelling (128th). Americans produced more often the color term magenta (8th) than British (17th). This was also the case for its equivalent fuchsia that Americans (38th) and British (58th) misspelled most commonly as fuschia. Teal was also offered more often by Americans (10th) than British (27th) but British produced more often turquoise (12th) than the Americans (18th). British used less often the color term salmon (30th) than the Americans and this was also apparent for the close neighbor category of peach (British: 22nd vs Americans: 17th).

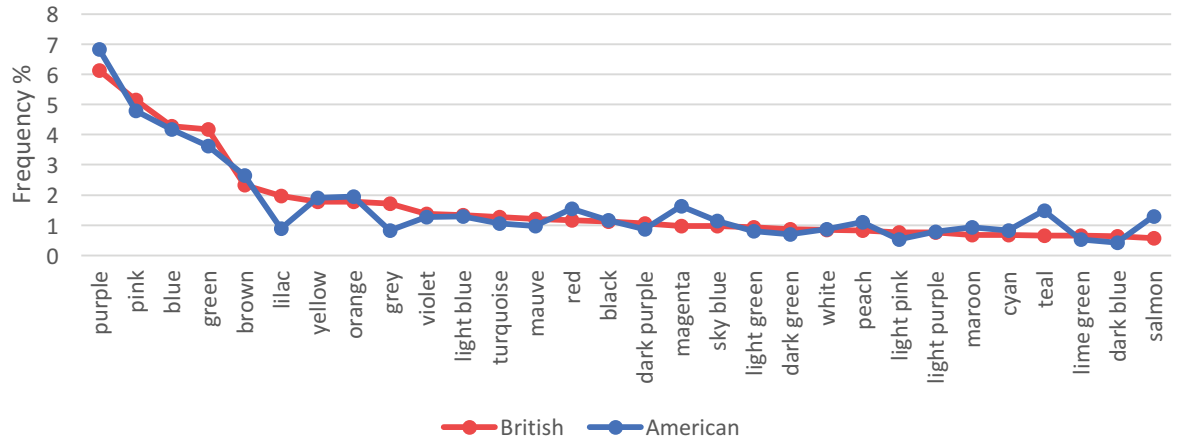

Figure 1: Frequency of occurrence of the 30 most frequent color names for British (red) and American (blue) English speakers. Ordered by British English.

The response times recorded for each of the eleven basic color terms was faster than non basic color terms for both British and Americans (Figure 2). Red was the fastest to respond term, followed closely by white. Americans were 10% faster than the British for the 30 faster responded color names but the differences were not significant Z=1.7076, p=0.09, r =1031. British were only faster producing the two-words descriptors light pink, lime green and sky blue.

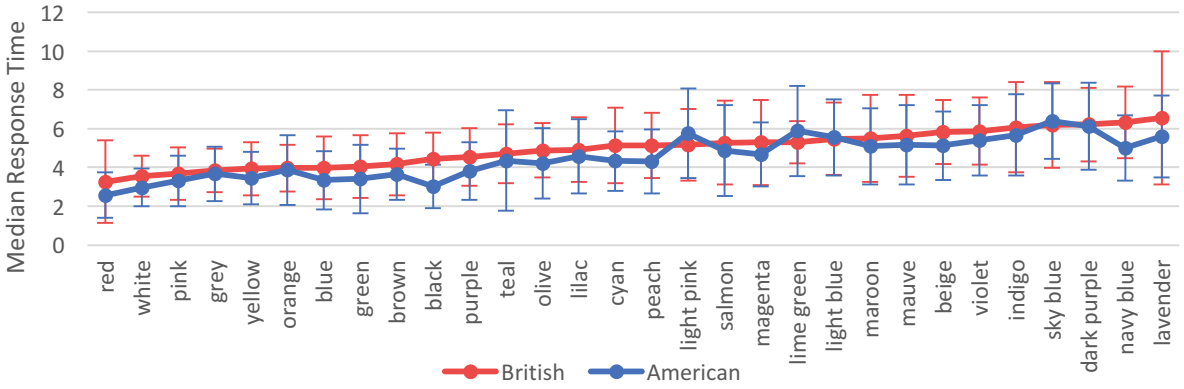

Figure 2: Median Response Time in seconds of the 30 faster to respond color names for British (red) and American (blue) English speakers. Ordered by British English. Bars indicate semi-quartile range.

A comparison of the centroids in CIE *L*a*b** coordinates for the eleven basic color terms produced a superior agreement (mean ΔE_{00}=1.3) between British and American speakers than the agreement between previous studies [1, 2] conducted in controlled viewing conditions (mean ΔE_{00}=7.4), with the largest difference (ΔE_{00}=2.7) for blue. For the top thirty most frequent British color names shown in Figure 3 their agreement was also very satisfactory (mean ΔE_{00}=2.4). The larger differences were found for teal (ΔE_{00}=11.2), mauve (ΔE_{00}=10.7) and lime green (ΔE_{00}=4.9). The best agreement was found for purple (ΔE_{00}=0.3) followed by lilac (ΔE_{00}=0.5), white (ΔE_{00}=0.6) and red (ΔE_{00}=0.7).

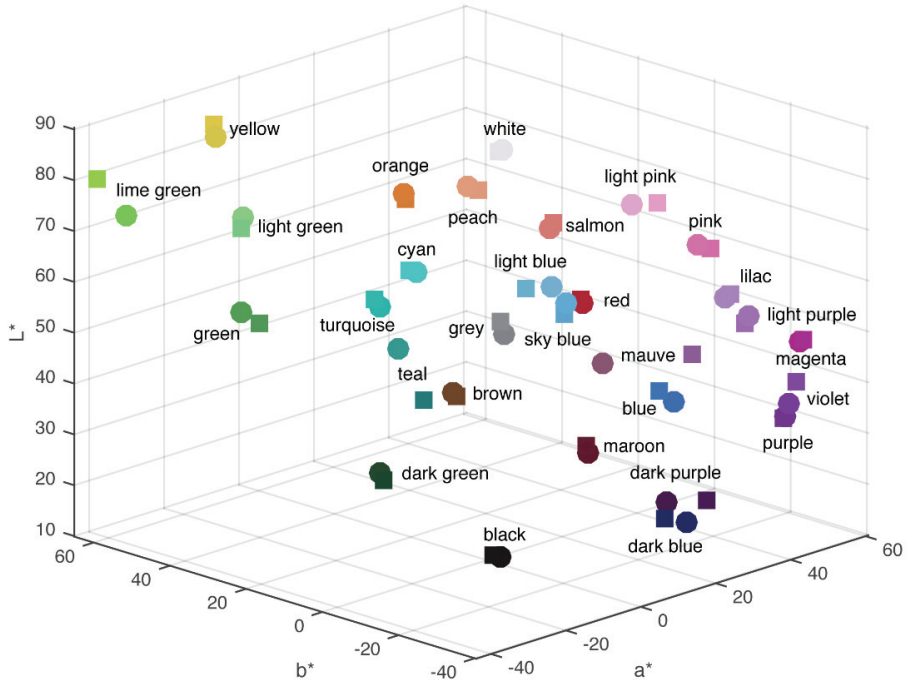

Figure 3: Location of centroids of 30 most frequent color names in CIELAB for British (square) and American (circle) English speakers.

To compare the variability of free color naming between British and American speakers, we measured the entropy of the histogram of the responses. For British the mean and standard deviation were 2.99 and 0.64 respectively and for Americans 2.88 and 0.68. Across stimuli, the degree of ambiguity in color naming was correlated between the two groups (R=0.55).

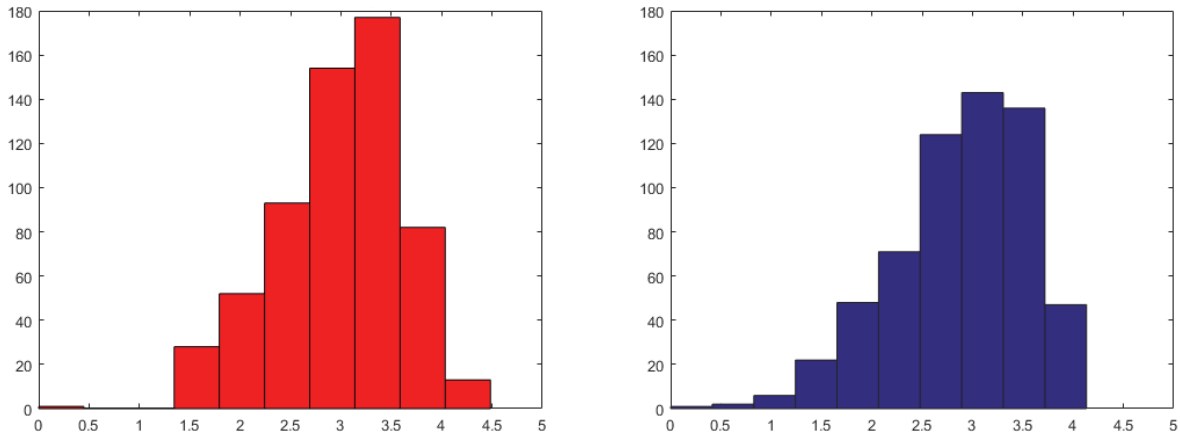

Figure 4: Histograms of entropy of the distribution of responses across stimuli for British (left-red) and American (right-blue) English speakers.

CONCLUSION

In summary, British and American English speakers appear to be more united than divided by a common color language but differences do exist. The actual colours denoted by teal, mauve, lime green and less so blue should be treated with caution. Our online experimental procedure produced a superior agreement between the locations of centroids for the eleven basic color terms than the comparison of previous studies performed in laboratories and this was also evident for the top thirty most frequent colour names. We believe the results of this study show the potential to enhance transatlantic color communication between British and American speakers of English.

ACKNOWLEDGEMENTS

We thank all the volunteers who have contributed in this study as participants in the online experiment. We also thank the Colour Group GB for the support towards the travel expenses for the AIC'17 conference in Jeju, South Korea. Dimitris Mylonas was supported by the University College London (UCL) Computer Science—Engineering and Physical Sciences Research Council (EPSRC) Doctoral Training Grant: EP/M506448/1 - 1573073.

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