Mandarin and Spanish basic color terms vis-à-vis

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Abstract

It is still debated how many basic color terms (BCTs) Mandarin has and how they are used compared to Western languages like Spanish. For clarifying this, we analysed the performance of 21 Mandarin speakers and 21 European Spanish speakers in two related tasks: the list task and the color naming task. Our results suggest that Mandarin has 9 BCTs in line with Gao and Sutrop (2014), while Spanish has 11 BCTs, in line with Lillo et al. (2007). We further found that Mandarin speakers use some of the common BCTs less consistently than Spanish speakers. Overall, both languages partition the color space similarly. Our findings show that there are universal constraints on color naming, that are compatible with subtle cross-cultural differences in how colors are used.

Keywords: basic color terms, Mandarin, Spanish, list task, color naming

Introduction

Despite numerous prior studies, important questions persist about basic color terms (BCTs) in the world's languages, including their exact number in many languages. According to Berlin and Kay (1969), Mandarin is a stage-V language with six BCTs. However, subsequent research using corpora and perceptual-cognitive methods has increased this number to nine (Gao and Sutrop, 2014), or perhaps eleven (Hsieh et al., 2020). According to Sun and Chen (2018), this uncertainty stems from a lexical problem: compared to other languages, Mandarin has more synonyms for each color category, so that basic color categories are referred to in more diverse (and thus inconsistent) ways (see also Hsieh et al., 2020 on dialectal differences). A second pending issue is to determine whether BCTs in Mandarin are distributed across the spectrum like in other languages, as already found in several many pairs on non-related languages, such as English vs. Japanese (Kuriki et al., 2017). In this paper, we contribute to this debate around the exact number and use of BCTs in Mandarin. We use Spanish for comparisons.

Method

Two experiments were conducted: the color list task and the color naming task (Davies & Corbett, 1994). For the color list task, we recruited 19 native

speakers of Mandarin from Mainland China (F = 10, age range 23-30, mean age = 27.2, *SD* = 2.3) and 19 native speakers of European Spanish (F = 9, age range 21-44, mean age = 25.5, *SD* = 5.0). In this task, participants were asked to list and write down all the color names from their native language they could remember. The maximum time allowed for this was 5 minutes. For the color naming task, we included 2 additional participants, up to a total of 21 Mandarin speakers (F = 11, age range 20-30, mean age = 26.7, *SD* = 2.8) and 21 European Spanish speakers (F = 10, age range 21-44, mean age = 25.7, *SD* = 4.8). In this task, participants were asked to name the 330 standard chips from the Munsell color chart, as used in the World Color Survey (www.icsi.berkeley.edu/wcs/), in an unconstrained way. Chips were presented in a random order, which changed from one subject to another. It took approximately 30-40 minutes for each participant to complete the task. Subjects with color blindness or vision problems were excluded from both tasks.

Data treatment and analysis

In the list task, for each of the colors that were mentioned by at least 5 subjects, we calculated its cognitive Salience index (S) (Sutrop, 2001), which measures the perceptive/cognitive bias that predisposes individuals to focus on it. In the naming task, for each of the dominant terms (i.e. terms used for at least half of the participants for a given tile), we calculated its Specificity Index (SI) (Gao & Sutrop, 2014), which measures the consensus among subjects for using it. To establish the number and the identity of the BCTs in each language, we relied on the results from both tasks (following the minimal criteria proposed by Gao and Sutrop, 2014), as well as the criteria for BCTs proposed by Berlin and Kay (1969)). Finally, in order to clarify how BCTs are used in each language, we used a multidimensional scaling to assess individual differences in naming for each BCT. We also used the Kernel Density Estimation (KDE) to determine the distribution of BCTs across the Munsell color chart.

Results

In the list task, Mandarin speakers generated 78 different color terms (M = 27.3), most of which were compounds and modified terms (e.g. *anhong* 'dark red'), while Spanish speakers generated 81 different color terms (M = 18.7), with most of them being single-word terms (e.g. *teja* 'brick red'). The highest cognitive Salience values were found for *hong* 'red' (S = .39), *huang* 'yellow' (S = .23) and *lan* 'blue' (S = .21) in Mandarin, and for *azul* 'blue' (S = .33), *rojo* 'red' (S = .31) and *verde* 'green' (S = .22) in Spanish. In the color naming task, Mandarin gave more different color names to each chip (M = 9.69, *SD* = 3.78) than Spanish speakers (M = 8.34, *SD* = 3.75) and this difference was significant (t(658) = 4.743, *d* = .36, *p* <.001). However, the highest SI value was found for 'black' in both languages. Overall, our results suggest that Mandarin has 9 BCTs: *hei* 'black', *bai* 'white', *zi* 'purple', *lü* 'green', *huang* 'yellow', *lan* 'blue', *hui*

'gray', *fen* 'pink' and *hong* 'red', whereas Spanish has 11 BCTs: *negro* 'black', *rojo* 'red', *naranja* 'orange', *blanco* 'white', *amarillo* 'yellow', *verde* 'green', *morado* 'purple', *rosa* 'pink', *gris* 'gray', *azul* 'blue' and *marrón* 'brown'. Finally, the multidimensional scaling revealed that Mandarin speakers showed more individual differences than Spanish speakers when using 'grey' (F (1,40) =12.61, p = .001), 'red' (F (1,40) = 4.29, p = .045), 'blue' (F (1,40) = 6.15, p = .02) and 'purple' (F (1,40) = 11.39, p = .002). By contrast, Spanish-speakers showed more variability when referring to 'red', 'blue', and 'purple', as illustrated by the additional peaks in the density plots (Fig. 1): one additional peak (*burdeos* 'bordeaux') for the 'red' category; two additional peaks (*celeste* 'light blue' and *turquesa* 'turquoise') for the 'blue' category, and two additional peaks for the 'purple' category (*violeta* 'violet' and *lila* 'lilac'). Despite these differences, both languages partition the color space similarly (see Fig. 2).

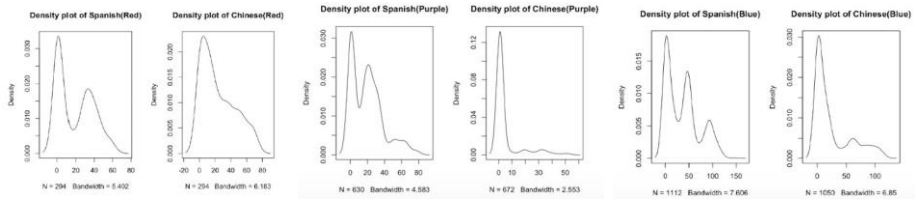

Figure 1. Density plots for red, purple and blue category in Spanish and Mandarin Chinese.

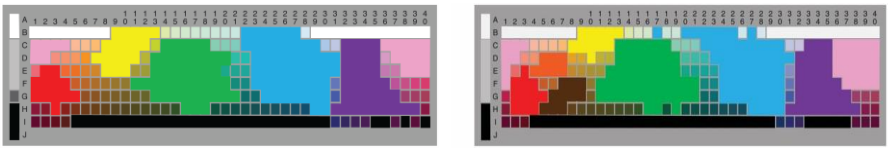

Figure 2. Map of the distribution of basic color categories for Mandarin speakers (left) and Spanish speakers (right).

Discussion and conclusion

Conway et al. (2020) have recently suggested that the BCTs in the Berlin-Kay scheme should be clustered according to their information content and communicative efficiency: warm colors (red, orange, yellow, brown), intermediate colors (purple, pink) and cool colors (blue, green), with cool colors being the less informative and efficient. Nonetheless, in our sample, we have found an opposite trend, with *hong* 'red', *huang* 'yellow' and *lan* 'blue' in Mandarin, and *azul* 'blue', *rojo* 'red' and *verde* 'green' in Spanish, being the most salient colors. At the same time, we have found that 'black' is used similarly in both languages, which parallels previous research (e.g. Ratliff et al., 2010), seemingly because blacks are prevalent in natural images.

Regarding the exact number of BCTs in both languages, we suggest that Mandarin has 9 BCTs, in line with Gao and Sutrop (2014). Contrary to some

other studies (e.g. Sun & Chen, 2018; or Hsieh et al., 2020), we found no evidence of *cheng* 'orange' and *zong* 'brown' being dominant colors in Mandarin. This can be due to methodological concerns (we relied on a free-choice paradigm, but not on a fixed-choice paradigm), or to sampling concerns (we tested Continental Mandarin speakers, but not Taiwanese Mandarin speakers). With regards to Spanish, our results support the view that it has 11 BCTs, in line with Lillo et al. (2007). Interestingly, in our experiment, the term *celeste* 'light blue' obtained a high S value (S=0.07) and possessed an SI value (SI=0.14). This suggests that this term might be emerging as a 12th BCT in Spanish. Likewise, we found that Spanish-speakers used more than one term for 'purple' and for 'blue', with these two terms, *violeta* 'violet' and *celeste* 'light blue', respectively, showing S values that were similar to the BCT *marrón* 'brown'. This suggests that additional color categories might be emerging in Spanish, in the line of Levinson's (2000) emergence hypothesis.

Overall, despite some differences between Mandarin and Spanish in the variability of BCT use, both languages partition the color space similarly. These is suggestive of some universal constraints on color naming, probably due to the common psychophysics of human color perception.

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