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# Making sense of free associations with PURPLE – A new coding scheme testing French speakers in three countries

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## Abstract

The colour category PURPLE is strangely heterogeneous, potentially due to the use of different cognates. We asked French speakers from Algeria, France, and Switzerland (*n* = 274) to produce up to three free associations with *violet* (basic term), *pourpre,* and *lilas* (non-basic terms). We counted 2,075 associations. We developed a coding scheme that i) covers nine major themes, and ii) shows high inter-rater reliability. Overall, the themes *colour terms* and *natural elements and objects* were most prominent showing that participants provided closely related associations. Finally, *violet* triggered more diverse semantic associations than *pourpre* or *lilas*. This was true for all countries. It seems that the basic term PURPLE carries more diverse associations and connotations than the non-basic terms.

***Keywords:*** *Colour psychology; basic colour terms; purple; semantic network models; cross-cultural*

## *INTRODUCTION*

Inquire on the Internet whether colour affects us – you will find a lot to read. Numerous contributions claim that colours impact us affectively and psychologically, from colours we add on ourselves via make-up or clothing, to the paint on our walls (Moore 2021). However, systematic studies that support such claims are missing, even if for affect, we have solid evidence that conceptual colour-affect relationships are universal (Adams and Osgood 1973; Jonauskaite et al. 2019; Jonauskaite, Abu-Akel et al. 2020). For psychological effects, evidence is largely limited to RED (Elliot 2015; Meier et al. 2012). Thus, to study the psychological meaning of colour, we simply asked people to freely associate with colour terms.

Free associations (FAs) are thought to provide a window into people's thoughts and feelings (Freud 1913), whether in clinical (Lothane 2018) or cognitive (Nelson et al. 2000) contexts. Semantic network models (Collins and Quillian 1969) help interpret type and speed of FAs; assuming that concepts represented by these FA are represented as "nods". Closely related concepts in these networks have close and strong connections. Unrelated concepts have remote and weak connections. If we activate the concept of MOTHER, semantic spreading activation would co-activate closely related concepts such as FATHER or CHILD, one of the fastest and first FAs. CATERPILLAR and VEHICLE, however, are remotely related, unless you are enthusiastic about construction vehicles including those by "CATERPILLAR". In this latter case, vehicle might be one of the first and fastest FAs.

Here, we used FAs to assess the psychological meanings of colour. French speakers from Algeria, France, and Switzerland provided FAs with numerous concepts including colour terms. We focus on results on PURPLE for the following reasons. First, we expect a wide range of FAs, because this colour category yields diverse affective meanings within and between languages (Jonauskaite, Abu-Akel et al. 2020; Jonauskaite, Parraga et al. 2020). Second, PURPLE seems an inconsistent basic colour

category (Uusküla 2007). Third, PURPLE is represented by different cognates such as *purple*, *violet* and *lilac* across languages (Berlin and Kay 1969; Bimler and Uusküla 2014; Jones 2013). To make sense of FAs, we used our new coding scheme consisting of nine major themes. We tested i) the inter-rater reliability, ii) whether frequent FAs are closely related, iii) whether FAs distribute differently across themes between cognates, and iv) for shared meanings across Algeria, France, and Switzerland.

## *METHOD*

### Participants

We recruited 274 (36 men) French native speakers from Algeria (*n* = 66, 6 men), France (*n* = 55, 7 men), and Switzerland (*n* = 153, 23 men). Participants had a mean age of 24.4 years (standard deviation (*SD)* = 0.71 years, range 18-74 years). Nobody was colour-blind by self-report. The study protocol was approved by the local ethics committee (number C_SSP_032020_00003).

### General procedure

We collected FAs with 16 colour terms, 20 emotion terms, and 26 filler terms (Fitzpatrick et al. 2015) through the online platform LimeSurvey (see all words in Table S1). After receiving written study information, participants provided informed consent and demographic information (age, gender, etc.). Then, they read the following instructions:

"*On the screen, you will see one word after the other. For each word, please write down the first three words that come to your mind. For example, you see the word SUN and SKY, YELLOW, BEAUTIFUL are the first words that come to your mind. In that case, you would write these words into the word field. There are no right or wrong answers, we are interested in your personal opinion."*

By clicking on the YES button, participants confirmed that they understood the task. Then, they saw the word list including violet, lilas, and pourpre in semi-randomized order, the colour terms never followed each other. After each word, participants provided up to three FAs. Upon study completion, they were thanked and debriefed. The entire study took about 15 minutes to complete.

### Development of the coding scheme

To identify recurrent themes, we used "open coding" in grounded theory (Glaser and Strauss 1967), "clustering" or "theme identification" as referred to in more eclectic approaches (Miles and Huberman 1994). A first coder (MQ) went over the word list to identify recurrent themes. Then, MQ and DJ defined six themes: *sensory experience, emotion, concrete item, nature, abstract concept* and *personal.* They could not code all FAs satisfactorily. Thus, we eliminated some themes and introduced new ones (see also Griber et al. 2018) having six themes: *experiential (sensory and affective experiences), human-made objects, non-human-made objects, abstract concepts, colour terms,* and *personal.* MQ and DE independently coded 156 FAs achieving an almost perfect inter-rater agreement, κ = 0.888. However, most FAs were allocated to *abstract concepts* (37.24%) and *natural objects and elements* (32.90%), thus, the coding scheme lacked precision. Accordingly, we introduced two major modifications by i) developing more precise themes (*n* = 9) and ii) adding subthemes (Table 1). Five themes had subthemes following Rosch's categorisation principles (1978), distinguishing between meta-level concepts, concrete examples, and very concrete examples that share many attributes. For the remaining themes, we either added different subthemes or none (see Table 1). DE and MQ coded another 20% of participants' responses. They had again a high agreement (κ = 0.848) and resolved disagreements through discussion. DE coded the remaining data.

| Themes | Definitions | Subthemes |
|---|---|---|
| 1. Experiential: sensory and affective experiences (65) | People associate experiences, feelings, physical sensations (e.g., *smell* (39), *soft* (26)). | Superordinate level (Emotion)<br>Basic level (Sadness)<br>Subordinate level (Intense sadness) |
| 2. Human-made objects (56) | People associate what is made or caused by humans (as opposed to nature) (e.g., *perfume* (28), *wine* (14), *clothes* (13)) | Superordinate level (Furniture)<br>Basic level (Chair)<br>Subordinate level (Kitchen chair) |
| 3. Natural elements and objects (408) | Everything that comes from nature, as opposed to what is made by humans (e.g., *flower* (336), *blood* (33), *lavender* (23), *octopus* (16)) | Superordinate level (Tree)<br>Basic level (Maple)<br>Subordinate level (Sugar Maple) |
| 4. Scenery (25) | Something complex and large, but labels visible parts of our environment, something we can point to (e.g., *spring* (25)) | Visible, concrete, (Sunset)<br>Abstract (Morning) |
| 5. Abstract concepts (10) | An abstract idea with no form (e.g., *feminism* (10)) | No other level (Christmas) |
| 6. People (32) | Also include a group of people and fictional characters (e.g., *name* (22), *woman* (10)) | Superordinate level (Woman)<br>Basic level (Princess)<br>Subordinate level (Catherine Middleton) |
| 7. Colour terms (575) | Everything related to colours that do not represent an opinion, e.g., *colour* (241), *violet* (165), *red* (85), *mauve* (46), *pourpre* (25), *blue* (13) | Superordinate level (Colour)<br>Basic level (Purple)<br>Subordinate level (Light purple) |
| 8. Personal (30) | Opinions or autobiographic responses (e.g., *pretty* (18), *beautiful* (12)) | Opinions (Beautiful)<br>Autobiographic responses (*my* room) |
| 9. Ambiguous words (82) | Every word that can have more than one meaning (*lilas* (42), *rose* (40)) | No other level (Church) |

Table 1: Details of the coding system (see Table S3 for complete information). Definition of the nine themes and subthemes resulting from the content analysis. We were inspired by Rosch's principle of categorisation (1978), (superordinate level, basic level, and subordinate level); but also adding other types of subthemes or no subthemes at all. In brackets, we indicate the numbers for the most frequent FAs (n), defined as those given by at least 10 participants in our data set for PURPLE (2,075 FAs). In Table S2, we show the complete list and counts of FAs with PURPLE.

### Data analysis

Most, but not all participants (81.3%) gave three FAs per cognate resulting in uneven numbers. Thus, we analysed our data per FAs and not per participant. We report on sub-themes elsewhere (see Table S2). Here, we report on the frequencies with which FAs fell into the nine major themes, for cognate, and country separately. First, we used chi-square tests of goodness of fit ($\chi$GF) to establish if themes were chosen at different frequencies i) overall (Table 2), and ii) as a function of cognate (Figure 1.A, Table 2). Second, we used chi-square tests of independence ($\chi$I) to establish if themes were chosen at different frequencies as a function of i) cognate (Table 2), and ii) country (Figure 1.B). If significant, we used standardized residuals to elucidate which themes drove the difference. We analysed the data with R v.1.4.1106 (R Core Team 2021).

## *RESULTS*

### Frequencies of themes and themes by cognate

The significant χGF, $\chi^2(8) = 1695.4$, $p < 0.001$, showed that the overall number of FAs differed between themes (see also Table 2 and complete results in supplementary material). Complementary χGFs for each cognate separately were significant: *lilas,* $\chi^2(8) = 810.33$, $p < .001$; *pourpre*, $\chi^2(8) = 769.85$, $p < .001$; *violet*, $\chi^2(8) = 450.29$, $p < .001$, showing that themes were chosen at different frequencies (Figure 1.A).

| **Overall** | | ***Violet*** | | ***Pourpre*** | | ***Lilas*** | |
|---|---|---|---|---|---|---|---|
| > | < | > | < | > | < | > | < |
| $3^{\#}$, $7^{\#}$ | $1^{\#}$, $4^{\#}$, $5^{\S}$, $6^{*}$, $8^{\#}$ | $5^{\#}$, $8^{\S}$, $9^{\#}$ | $7^{\#}$ | $2^{\#}$, $5^{\S}$, $7^{\#}$ | $1^{\#}$, $3^{\#}$, $6^{*}$ | $1^{\#}$, $3^{\#}$, $4^{\#}$, $6^{\#}$ | $2^{\#}$, $5^{\#}$, $7^{\S}$, $9^{\#}$ |

Table 2: Standardized residuals show which themes were chosen more (>) and less (<) frequently than expected by chance (overall) or when comparing one cognate to the other two. Numbers represent themes of Table 1 (also see Figure 1). $^{*}p < .05$, $^{\S}p < .01$, $^{\#}p < .001$.

### Association frequencies as a function of theme and cognate

The significant χI, $\chi^2(16) = 246.41$, $p < .001$, showed that the number of FAs differed as a function of themes and cognates (see words and their counts in supplementary material). Table 2 shows themes that were chosen more or less frequently for one of the cognates compared to the other two cognates (for complete results, see supplementary material)

### Association frequencies as a function of theme and country

The χI failed the conventional significance level, $\chi^2(16) = 26.01$, $p = 0.053$. Exploring country differences per cognate tentatively, we found no difference for *lilas*, $n = 705$, $\chi^2(16) = 24.14$, $p = 0.086$, and *pourpre*, $n = 686$, $\chi^2(16) = 25.07$, $p = 0.068$, but we did for *violet, n* = 684, $\chi^2(16) = 37.12$, $p = 0.002$. Standardised residuals on *violet* indicated that Swiss participants associated *abstract concepts* more often than Algerian and French participants, 16.3%, $z = 3.13$, $p < .01$, and associated *experiential* less often than Algerian or French participants, 5.8%, $z = -2.41$ $p < .05$ (Figure 1.B).

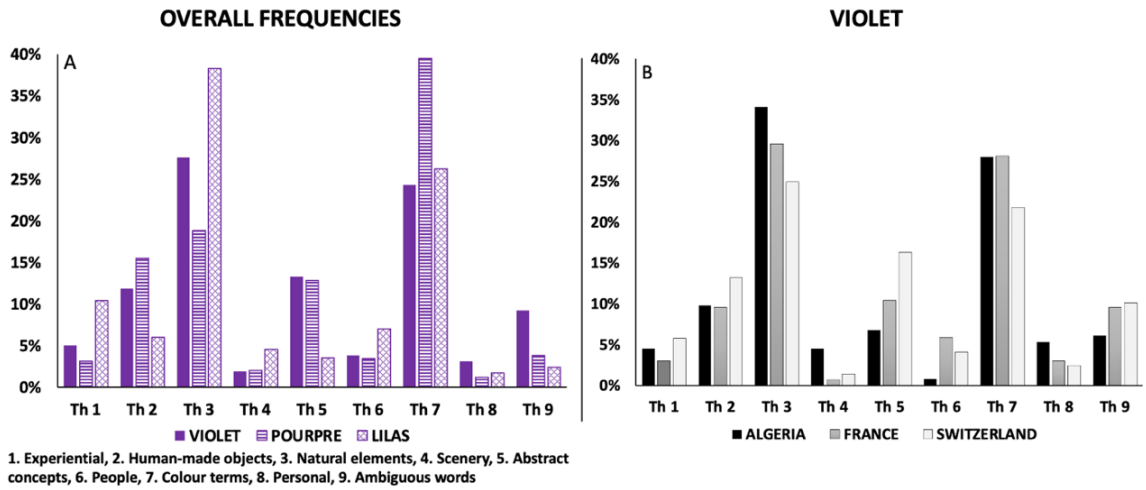


Figure 1: Percentages with which A) 2,075 FAs have been allocated to the nine major themes as a function of cognate, and B) 684 FAs with violet have been allocated to the nine major themes as a function of country (B). Significant standard residuals are coded as $^{*}p < .05$, $^{\S}p < .01$.

## *DISCUSSION*

We studied the psychological meanings of PURPLE using FAs, inspired by semantic network models. Participants from Algeria, France and Switzerland provided 2,075 FAs with the words *violet*, *pourpre* and *lilas.* Using these FAs, we developed a coding scheme consisting of nine major themes. This scheme is promising because first, we achieved high inter-rater reliability; second, frequent FAs belonged to closely related concepts (i.e., *natural elements and objects* and *colour terms*), and third, the number of FAs differed between themes, and as a function of theme by cognate. For instance, FAs were most frequently allocated to *colour terms* and *natural elements and objects*.

Looking closely at results by cognate, some themes were biased towards *lilas:* i) *natural elements and objects,* ii) *experiential*, iii) *people* and iv) *scenery.* For *pourpre* we found biases towards i) *colour terms*, ii) *human-made objects,* and iii) *abstract concepts.* For *violet,* we found biases towards i) *ambiguous words*, ii) *abstracts concepts*, and iii) *personal.* Thus, the most frequent themes were more prominent for the non-basic colour terms than the basic ones. We conclude that FAs for the basic colour term are more diverse, distributing across more themes than the FAs for non-basic colour terms. Importantly, this conclusion was true for all three French speaking countries indicating that psychological meaning is widely shared within the same language, even if spoken in different countries. This could be because basic colour terms are embedded in various living experiences, which could be more diverse than those in which non-basic colour terms are employed.

To test whether our coding scheme proves powerful to determine the psychological meaning of colour more generally, we must study FAs beyond both French speaking populations and PURPLE. For instance, *violet* is the basic colour term in Italian and Lithuanian, but in English and Bulgarian it is *purple,* and in German and Estonian it is *lilac*. Thus, if our results generalize, we should observe that FAs distribute across more themes for the basic than non-basic colour terms, irrespective of cognate or country. Finally, because themes differed between the three colour terms, the actual FAs might help understand whether inconsistent findings for the category boundaries of PURPLE (Uusküla, 2007) resulted from different cognates being basic colour terms between languages. Our most frequent FAs showed that both *lilas* and *violet* were associated with both *mauve* and *rose*, while *pourpre* was associated with *red*. Perhaps, countries using *purple* as the basic term have a mental representation of PURPLE that is more strongly shifted towards red than those using *violet* or *lilac*. Such studies might help why we observe inconsistent colour-emotion associations with PURPLE (Jonauskaite, Abu-Akel et al., 2020; Jonauskaite, Parraga, et al., 2020; Jonauskaite, Wicker, et al., 2019)**.**

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