Epicoco, D., Mohr, C., Uusküla, M., Quiblier, M., Bouayed Meziane, M., Laurent, E., Spagnulo, G.F.M., & Jonauskaite, D. (2023). The PURPLE mystery: Semantic meaning of three purple terms in French speakers from Algeria, France, and Switzerland. *Color Research & Application,* 1-20. doi:10.1002/col.22908

# The PURPLE mystery: Semantic meaning of three purple terms in French speakers from Algeria, France, and Switzerland

Déborah Epicoco[1*], Christine Mohr[1], Mari Uusküla[2], Michael Quiblier[1], Maliha Bouayed Meziane[3], Eric Laurent[4], Giulia F. M. Spagnulo[1], and Domicele Jonauskaite[1,5]

[1]Institute of Psychology, University of Lausanne, Lausanne, Switzerland
[2]School of Humanities, Tallinn University, Tallinn, Estonia
[3]LGSDS, École Nationale Polytechnique, Algiers, Algeria
[4]Université de Franche-Comté, LINC, Besançon, France
[5]Faculty of Psychology, University of Vienna, Vienna, Austria

*Corresponding author: Déborah Epicoco, Faculty of Social and Political Sciences, Institute of Psychology, University of Lausanne, Lausanne, Switzerland, https://orcid.org/0000-0001-8683-3000, deborah.epicoco@unil.ch

Author contributions:
Conceptualisation: DE, CM, MU, DJ
Formal analysis: DE, MQ, GFMS, DJ
Funding acquisition: CM, DJ
Investigation: DE, CM, MU, MBM, EL, DJ
Methodology: DE, CM, DJ
Supervision: CM, DJ
Visualization: DE, CM, DJ
Writing – original draft: DE, CM, MU, DJ
Writing – review & editing: DE, CM, MU, MQ, MBM, EL, GFMS, DJ

**Acknowledgements:** We published a shorter version of this study together with the dataset (Epicoco et al., 2021; https://serval.unil.ch/en/notice/serval:BIB_B9812E007CB2) in AIC 2021 Proceedings. The current research was supported by the Swiss National Science Foundation, providing career fellowship grants to DJ (P0LAP1_175055; P500PS_202956; P5R5PS_217715) and a project funding grant to CM (100014_182138). The latter is supporting DE's doctoral studies. No conflicts of interest are declared.

**Abstract**

Studies on the colour category PURPLE yielded inconsistent category boundaries, focal colours, and colour-emotion associations. In French, there are at least three colour terms referring to the shades of purple, potentially weighing on these inconsistencies. Thus, we tested the semantic breadth and richness in semantic meaning of *violet* (basic term), *lilas* (non-basic), and *pourpre* (non-basic). We collected free associations in 274 French speakers from Algeria, France, and Switzerland, yielding 2,079 responses, of which 436 were discrete and 275 were unique. Frequency analyses and semantic coding supported the basicness status of *violet* in French, within a hierarchically structured semantic system. Moreover, the meaning of the three terms was not synonymous. *Violet* had the most abstract meaning. *Lilas* had the narrowest meaning, mainly referring to Natural Entities. *Pourpre* seemed close to RED. We found no differences between the countries. Future studies should extend this approach to other languages and other colour terms.

**Keywords:** Colour psychology; cross-cultural study; basic colour terms; non-basic colour terms; free associations

Summary word count: 150 words (max 150 words)

Word count: 5,410 words

## 1. Introduction

Colour provides important sensory information, helping us to orient in an ever-changing world. For instance, we can more easily spot our red car in a busy car park, decide when to safely cross the road, or identify people in a noisy environment. When using colour information, we likely think of colours in terms of colour categories, namely distinct entities such as RED and BLUE. We use colour terms for these categories encompassing many shades of similar colours. Perceptually, however, colour is not categorical, but continuous, and can be placed along a three-dimensional space. The latter can be described in terms of hue, lightness, and saturation (Witzel, 2019). Thus, we encounter a situation in which we can perceptually experience many shades of colour, but linguistically, we use only a limited number of colour terms to categorise, describe, and talk about these shades.

Systematic studies found that speakers of different languages similarly cluster shades of colour into colour categories as well as name them (e.g., Berlin & Kay, 1969; Biggam, 2012). These studies showed that most modern languages use 11 or 12 basic colour terms. They are called basic, because these terms are used and understood by nearly all native speakers of a given language (Kay & McDaniel, 1978; Kay & Regier, 2003; Mylonas & MacDonald, 2012). Important here, the colour category PURPLE has been problematic. Participants disagreed about i) which colour patches were the best examples of the PURPLE category (i.e., focal colours, Lindsey & Brown, 2014; Sturges & Whitfield, 1995); ii) where boundaries of this colour category lay (Uusküla, 2007; Uusküla & Bimler, 2016); and iii) which emotions should be associated with the basic colour term *purple*, both within a language (French speakers; Jonauskaite, Parraga, et al., 2020) and across languages (Hupka et al., 2016; Jonauskaite, Abu-Akel, et al., 2020; Uusküla et al., 2023).

Intrigued by these findings, we considered whether semantic connotations of the PURPLE category might help us understand these disagreements. We noticed that languages use different words for the colours falling into the PURPLE category (e.g., terms like *purple*, *lilac*, *violet*). Only one of these terms is the basic one while the other two terms are non-basic (see Uusküla et al., 2023). For example, in English, *purple* is the basic term, while *lilac* and *violet* are non-basic terms. In German, *lila* is the basic term, while *purpur* and *violet* are non-basic terms. In French, *violet* is the basic term, while *lilas* and *pourpre* are non-basic terms (Forbes, 2006; Lindsey & Brown, 2014; Majid et al., 2015).

In the current study, we tested the breadth and richness of semantic meaning of these three PURPLE terms in French – *violet*, *lilas*, and *pourpre*. We expected the semantic meaning of the basic colour term (i.e., *violet*) to be more diverse than that of the non-basic terms, because, at least theoretically, it includes all shades of the PURPLE category. In contrast, the non-basic terms might be more restrictive and more specific, including only a subset of shades. For instance, the English term *violet* is characterised by lighter and bluer shades of purple than the term *purple* (Lindsey & Brown, 2014; Tager, 2018).

To gather semantic meaning of these three terms of PURPLE, we ran a free association study, testing French speakers from Algeria, France, and Switzerland (see also Epicoco et al., 2021). Participants provided free associations with the basic term *violet*, and non-basic terms *lilas*

and *pourpre*[1]. We worked with free associations, because results from clinical (Lothane, 2018) and general populations (Siew et al., 2019) indicated that free associations provide insight into how people structure semantic knowledge. Semantically more closely related words would be recalled earlier and more quickly than less closely related words. For instance, when given the concept FATHER, participants are likely to say MOTHER, PARENT, or FAMILY. They are less likely to say CLOUD, because there is no obvious correspondence with the concept of FATHER, at least not on a population level.

To organise the dataset of free associations overall and as a function of colour term, we applied three approaches. First, we accounted for the semantic meaning of the responses by applying a recently developed semantic coding scheme, consisting of nine major semantic themes (Epicoco et al., 2021). Second, we determined discrete responses by disregarding the number of times each response was given. Finally, we worked with response frequencies, hence accounting for repetitions, separating the responses into unique, rare, frequent, and highly frequent discrete response frequency categories.

We expected responses to be more widely distributed in the semantic space for the basic (i.e., *violet*) than the non-basic (i.e., *lilas* and *pourpre*) terms. Consequently, we could test whether responses and discrete responses were more numerous for the basic than the non-basic terms. Even if the basic and non-basic terms did not differ on the number of responses or discrete responses, there might be differences in response frequencies. Potentially, we could observe a higher number of unique responses generated for the basic term. We expected different semantic themes to be popular for the basic and the non-basic terms, with more abstract associations provided for the basic colour term (Rosch, 1978). Finally, we expected cultural differences to be small, because emotion associations with basic colour terms seem widely shared (Adams & Osgood, 1973; Jonauskaite, Abu-Akel, et al., 2020), although the category PURPLE has often been an exception (Jonauskaite, Abu-Akel, et al., 2020; Jonauskaite, Parraga, et al., 2020; Uusküla et al., 2023).

## 2. Method

### 2.1. Participants

We recruited 274 (36 men, 238 women) French speakers from Algeria (*n* = 66, 6 men, 61 women), France (*n* = 55, 7 men, 47 women), and Switzerland (*n* = 153, 23 men, 130 women). None of our participants chose to identify themselves as non-binary. Most of our participants were native French speakers, apart from Algerian participants, who also spoke Arabic. Nonetheless, we ensured that all our participants were fluent in French by selecting only

[1] When we display colour terms in *italics*, we denote words as they are written in the original language. Thus, when we write *violet*, *lilas*, and *pourpre*, we refer to French words. In the current study context, we cannot directly translate these terms in other languages, because we have to distinguish between terms that are basic and that are non-basic. For instance, *violet* in French should not be translated to *violet* in English, but rather to *purple* in English, since *violet* in French and *purple* in English both are the basic colour terms, denoting the colour category PURPLE. Likewise, *pourpre* in French should not be translated to *purple* in English, since *pourpre* is not the basic colour term in French and so, it would not have the same breadth (visually and semantically) as the English term *purple*. Accordingly, we kept the original French terms throughout the text.

those who indicated that their French fluency was at least 6 out of 8. Most participants were first year psychology students and others were recruited from our collaborators' networks. We selected non-colour-blind participants, based on self-report. Our participants had a mean age of 24.4 years (*SD* = 0.71 years, range 18-74 years). The study protocol was approved by the local ethics committee (C_SSP_032020_00003).

### 2.2. Stimuli

We collected free associations with 62 French words. The complete set of words included i) 16 colour terms, including the colour terms *violet*, *lilas*, and *pourpre*, which were target words in this study; ii) 20 emotion terms, taken from the Geneva Emotion Wheel (Scherer et al., 2013); and iii) 26 filler words, such as animals and household items, taken from Fitzpatrick et al. (2015). The complete set of words is presented in Table S1.

### 2.3. General procedure

We collected data on the Limesurvey online platform. After obtaining written study information participants provided informed consent and demographic information, consisting in age, gender, native language, fluency of the survey language (here, French), country of origin, country of residence, occupation, and whether they were colour blind or not. Afterwards, participants 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. Then, SKY, YELLOW, and BEAUTIFUL might be 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 they understood the task. We showed the 62 words in a semi-randomized order, so that *violet*, *lilas*, and *pourpre* never followed each other. For each target word, participants provided up to three responses (free associations). The entire study took on average 22 minutes to complete. We thanked and debriefed participants at the end.

### 2.4. Data analysis

We extracted 2,079 responses, given as associations with the colour terms *violet*, *lilas*, and *pourpre*. More than half of the participants (52.92%) generated the maximum of three responses per colour term (nine responses in total). The remaining participants (47.08%) might have thought that they had to generate one response per colour term resulting in three responses in total. Therefore, we had an uneven number of responses between participants. Consequently, we analysed the data per response and not per participant (see complete raw dataset in Table S2 and treated dataset in Table S3). We analysed the semantic meaning of the responses as well as looked at discrete responses and response frequencies. We set the alpha levels for all tests at $p < .050$. We analysed the dataset with R (version 4.2.0) and R Studio v.1.4.1106 (R Core Team, 2022).

#### *2.4.1. Semantic themes*

To analyse the semantic meaning of participants' responses, we used a recently developed coding scheme comprised of nine major themes: i) Sensory and Affective Experiences, ii) Human-Made Entities, iii) Natural Entities, iv) Scenery, v) Abstract Concepts, vi) People, vii) Colour Terms, viii) Personal Responses, and ix) Ambiguous Words (also see Epicoco et al., 2021). Seven of these themes had subthemes, which we did not further analyse here. We present definitions and examples of the semantic themes and subthemes in Table 1 (see Appendix for the full explanation of the development of the coding scheme).

Two co-authors coded 20% of the data in the response set. Their kappa value ($\kappa = 0.848$) showed a high inter-rater agreement (Cohen, 1988). Thus, we confidently categorised each response into one of the nine semantic themes. To establish whether certain themes were more prevalent than others, we used a chi-square goodness of fit test. Then, to compare frequencies of themes as a function of colour term (i.e., *violet, lilas, pourpre*) as well as a function of country (i.e., Algeria, France, Switzerland), we used chi-square tests of independence. When the tests were significant, we interpreted the effects using standardised residuals.

#### *2.4.2. Discrete responses and response frequencies*

When we looked at all the given responses ($N$ = 2,079), we observed that many responses were generated repeatedly across participants as well as across colour terms (e.g., FLOWER, COLOUR). In the first step, we disregarded repetitions by considering each *discrete response* once (e.g., WINE, BLOOD) and so we identified 436 discrete responses (see different discrete responses in Figure 1). And indeed, some of the discrete responses were generated once (unique responses), while others were generated multiple times. Thus, in the second step, we counted how often each discrete response appeared in the response set. Based on that, we established *response frequencies*, approximately represented in Figure 1 by the size of the responses. In addition to *unique* responses, we determined *rare*, *frequent*, and *highly frequent* response categories.

We determined rare responses as those appearing at least twice and a maximum number of 20 times (i.e., < 1%) in the total response set. The discrete response BLUE was a rare response, mentioned 13 times and constituting 0.6% of the response set (i.e., 13/2,079*100). For frequent responses, we applied a cut-off between 1% and 5%. Thus, frequent responses appeared between 21 and 103 times. The discrete response BLOOD was a frequent response, mentioned 34 times and constituting 1.7% of the dataset. Finally, highly frequent responses appeared beyond the cut-off score of 5% (see also Chermahini & Ho. mmel, 2010). Thus, highly frequent responses were found at least 104 times (i.e., 2,079*5/100). The discrete response FLOWER was a highly frequent response, mentioned 333 times, constituting 16% of all responses.

##### *2.4.2.1. Colour-specific response sets*

We determined discrete responses and their frequencies in the response sets for *violet, lilas, and pourpre* separately. After having done so, we again counted how often each discrete response appeared in each of the colour-specific response set. We again categorised discrete responses into unique, rare, frequent, and highly frequent responses.

By default, a unique response in the total response set was also a unique response in one of the three colour-specific response sets. For instance, the discrete response CHRISTMAS was a unique response from the *pourpre* response set. When a discrete response appeared twice in the total response set, it might have appeared twice in one colour-specific response set or once in two colour-specific response sets. For instance, the discrete response TULIP was generated twice and both times as a response for *lilas*. In contrast, the discrete response VAMPIRE was also generated twice, but once for *violet* and once for *pourpre*. Thus, VAMPIRE was a unique response in the *violet* and *pourpre* response sets, but it was a rare response in the total response set. When a discrete response appeared multiple times in the total response set, it might have appeared only in one colour-specific response set, in two, or in all three colour-specific response sets. The latter was true for the discrete response FLOWER, which appeared 104 times in the *violet* response set, 215 times in the *lilas* response set, and 14 times in the *pourpre* response set.

Now, we faced the situation that some discrete responses changed their response frequency category when being considered in the total response set and the colour-specific response sets (see the examples of VAMPIRE above). To take another concrete example, FLOWER was a highly frequent response in the total response set. However, it appeared only 14 times in the *pourpre* response set, making it a frequent but not a highly frequent response (i.e., 14/702*100% = 2.0%). In other words, FLOWER changed the response frequency category for *pourpre*. FLOWER remained a highly frequent response in the other two colour-specific response sets, constituting 30.5% of all responses for *lilas*, and 15.2% for *violet*.

For statistical analyses, we used chi-square tests of independence to establish whether the frequencies of discrete responses, as well as the frequencies of unique, rare, frequent, and highly frequent responses, calculated in the total and colour-specific response sets, differed between the three colour terms and the countries. We also used chi-square tests of independence to determine whether the response frequency categories differed in their semantic content. When tests were significant, we used standardized residuals to interpret the effects.

**Table 1. Explanations of the nine semantic themes and their subthemes, including representative examples.**

| Themes | Explanations of themes | Subthemes | Examples |
|---|---|---|---|
| 1.Sensory and Affective Experiences | Experiences, feelings, and sensations such as smells, sounds, flavours, temperature but not colours. | Superordinate level<br>Basic level<br>Subordinate level | Temperature, Emotion<br>Warm, Anger<br>Scalding hot, Intense Anger |
| 2. Human-Made Entities | Entities made or caused by humans as opposed to nature. They were made or created to serve a particular function. | Superordinate level<br>Basic level<br>Subordinate level | Furniture, Human living space<br>Lamp, City<br>Desk lamp, Paris |
| 3. Natural Entities | Tangible objects or entities that come from nature, as opposed to what is made by humans. Importantly, these objects and entities can be touched or held, and not only seen. | Superordinate level<br>Basic level<br>Subordinate level | Plant, Human tissue<br>Flower, Blood<br>Tulip, Dried blood |
| 4. Scenery | Non-tangible entities that come from nature. They cannot be touched but they can be seen (concrete level) or experienced (abstract level). | Concrete level<br>Abstract level | Sunset, Field<br>Morning, Spring |
| 5. Abstract Concepts | Abstract concepts or ideas with no particular form. They cannot be seen or felt by any senses. | No subthemes | Moral, Elegance |
| 6. People | People, groups of people, or fictional characters. | Superordinate level<br>Basic level<br>Subordinate level | Female, Person<br>Princess, Uncle<br>Kate Middleton, Uncle Peter |
| 7. Colour Terms | Colour terms and explicit descriptors of colour. | Superordinate level<br>Basic level<br>Subordinate level | Pastel colour, Colour<br>Pink, Blue<br>Light pink, Prussian blue |
| 8. Personal Responses | Personal experiences, opinions, or memories of the respondent. | Opinions<br>Autobiographic responses | A pretty colour, Royal<br>Mine, My grandmothers' house |
| 9. Ambiguous Words | Words that have several meanings, and the correct meaning cannot be disambiguated without making assumptions. It also includes words that cannot be categorised elsewhere. | No subthemes | Church (institution or building),<br>Light (daylight, room light or car-light) |

*Note*. This coding scheme has been developed to mainly categorise nouns, since nouns were most prevalent part of speech in our set of responses. However, other parts of speech can also be categorised with this scheme. For instance, verbs (e.g., dance, sing) would be categorised as Abstract Concepts. Adjectives would be categorised as Sensory and Affective Experiences (e.g., sad, warm, soft) or Personal Responses (e.g., beautiful, ugly, good), depending on their semantic content. Pronouns (e.g., she, he, they) would be categorised as People unless it is a personal pronoun (e.g., my, mine). Personal pronouns would be categorised as subtheme Personal Opinions, inside the theme Personal Responses. In the rare cases, when an adverb (e.g., greatly, currently), a preposition (e.g., on, in, under), a conjunction (e.g., and, or), or an interjection (e.g., wow, hooray) were given as separate words, they would be categorised as Ambiguous Words (see the full explanation of the coding scheme in supplemental material, https://osf.io/pynjm).

## 3. Results

### 3.1. All responses

Our participants generated 2,079 responses in total (Figure 1). We grouped these responses by semantic content into nine semantic themes (Table 2). Responses did not fall into the nine themes at the same frequencies, $\chi^2(8) = 1531.3$, $p < .001$ (see "All responses together" in Table 2). A greater number of responses than expected by chance were categorised to the themes Natural Entities ($p < .001$) and Colour Terms ($p < .001$), suggesting that these themes were the most popular. A smaller number of responses than expected by chance were categorised to the themes Sensory and Affective Experiences ($p < .001$), Scenery ($p < .001$), People ($p < .001$), Abstract Concepts ($p < .001$), Personal Responses ($p < .001$), and Ambiguous Words ($p < .001$), suggesting that these themes were less popular. A chi-square test of independence comparing the frequencies of responses per theme and country was not significant, $\chi^2(16) = 17.25$, $p = .369$. Thus, the frequencies of responses in each theme were comparable for the French speakers in Algeria, France, and Switzerland.

From the 2,079 responses, 686 responses were given for the term *violet,* 705 responses for the term *lilas*, and 688 responses for the term *pourpre*. The number of responses did not significantly differ between the three colour terms, $\chi^2(2) = 0.31$, $p = .850$. When testing their semantic content, the chi-square test of independence was significant, $\chi^2(16) = 217.6$, $p < .001$, indicating that, for each term, responses did not fall into the nine themes at the same frequencies (see Table 3). Based on the standardised residuals, for *violet,* a greater number of responses fell into the themes Abstract Concepts ($p < .001$) and Ambiguous Words ($p < .001$) than expected by chance. For *lilas,* a greater number of responses fell into the themes Sensory and Affective Experiences ($p < .001$), Natural Entities ($p < .001$), Scenery ($p < .001$), and People ($p < .05$) than expected by chance. For *pourpre*, a greater number of responses fell into the themes Human-Made Entities ($p < .001$) and Colour Terms ($p < .001$) than expected by chance (see Table 3 for the under-represented themes). We did not have enough responses to run such analyses per country, yet we display the frequencies per country in Table A1, Table A2, Table A3.

### 3.2. Discrete responses

We had 436 discrete responses in total. Some of the discrete responses repeated across the colour terms while others did not. Thus, there were 231 discrete responses for *violet,* 103 discrete responses for *lilas*, and 210 discrete responses for *pourpre* (see also Table 4). The number of discrete responses differed between the three colour terms, $\chi^2(2) = 52.0$, $p < .001$. Standardized residuals showed that *lilas* yielded fewer discrete responses than expected by chance ($p < .001$), while *violet* ($p < .001$) and *pourpre* ($p < .010$) yielded more discrete responses than expected by chance, and the latter were not different from each other ($p = .317$). We did not have enough responses to run such analyses per country, yet we display the frequencies per country in Table A4.

On a descriptive level, there were three highly frequent discrete responses and 11 frequent discrete responses in the total response set (we list all frequent and highly frequent responses as well as their corresponding semantic themes in Table 5). These discrete responses

appeared in all colour-specific response sets, with three exceptions. The frequent response SMELL was only found in the *violet* and *lilas* response sets, the frequent response BLOOD appeared only in the *pourpre* response set, and the frequent response FIRST NAME appeared only in the *lilas* dataset. Incidentally, Lilas is a common female first name in French. In fact, some discrete responses were generated only for one colour term. For instance, FEMINISM was only generated for *violet*, GARDEN was only generated for *lilas*, and BLOOD was only generated for *pourpre* (we list all non-unique discrete responses in Table 6). These responses might be indicative of their corresponding colour terms.

The number of highly frequent, $\chi^2(2) = 0.00$, $p = 1.00$, and frequent, $\chi^2(2) = 0.07$, $p = .965$, discrete responses was nearly identical across the three colour terms in the total response set (see Table 4, "Criteria applied to the total response set"). The number of rare discrete responses differed between the three colour terms, $\chi^2(2) = 20.71$, $p < .001$, with more rare discrete responses generated for *violet* ($p < .05$) and *pourpre* ($p < .05$) and fewer for *lilas* ($p < .001$) than expected by chance. The number of unique discrete responses also differed between the three colour terms, $\chi^2(2) = 38.68$, $p < .001$, with more unique discrete responses generated for *violet* ($p < .001$) and fewer for *lilas* ($p < .001$).

#### *3.2.1. Colour-specific response sets*

We observed that some discrete responses changed category, explaining different counts in Table 4 in the total vs. colour-specific response sets. We determined the change of discrete response category based on the total response set vs. colour-specific response sets. Forty-eight responses changed frequency category between the total response set vs. the *violet* response set; 20 responses changed their frequency categories between the total response set vs. the *lilas* response set, and 43 responses changed their frequency categories between the total response set vs. the *pourpre* response set (see all such responses in Table 7). For example, there were changes for RED and BLUE discrete responses denoting adjacent basic colour categories. The rare discrete response BLUE changed to a frequent term in the *violet* response set, indicating that there was a semantic correspondence between the colour categories PURPLE (denoted with the basic term *violet*) and BLUE. The frequent discrete response RED changed to a rare discrete response for *violet* and to a unique term for *lilas*, telling us that there was a semantic correspondence between RED with *pourpre,* but not with the basic PURPLE category (denoted with the basic term *violet*). See other cases of category change in Table 7.

### 3.3. Semantic content by response frequency category

The initial responses were not equally distributed across the semantic themes and the response frequency categories, $\chi^2(24) = 1320.1$, $p < .001$ (Table 8). Compared to chance, i) all highly frequent responses fell into two categories – Natural Entities and Colour Terms, while other themes remained unused, ii) more frequent responses fell into the themes Natural Entities, Colour Terms and Ambiguous Words, iii) more rare responses fell into the themes Human-Made Entities and Natural Entities, and iv) more unique responses fell into the themes Human-Made Entities and Abstract Concepts (see Table 8 for under-represented themes).

The distribution of responses across the semantic themes differed across *violet*, *lilas*, and *pourpre* for highly frequent, $\chi^2(6) = 391.8$, $p < .001$, frequent, $\chi^2(14) = 249.0$, $p < .001$, rare $\chi^2(16) = 92.8$, $p < .001$, but not unique, $\chi^2(16) = 13.5$, $p = .637$, response frequency categories (see Table 9). For the highly frequent response category, i) all responses falling to Sensory and Affective Experiences were generated for *lilas*, ii) all responses falling to Natural Entities were generated for *violet* or *lilas*, iii) all responses falling to Ambiguous Words were generated for *violet*, and iv) more responses falling to the theme Colour Terms were generated for *pourpre* than expected by chance. For the frequent response category, i) more responses falling to the theme Colour Terms were generated for *violet,* ii) more responses falling to the themes Sensory and Affective Experiences, Human-Made Entities, and People were generated for *lilas*, and iv) more responses falling to the theme Natural Entities were generated for *pourpre* than expected by chance. When it came to the rare response category, i) more responses falling to the themes Sensory and Affective Experiences, Natural Entities, Scenery, and People were generated for *lilas*, and ii) more responses falling to the theme Human-Made Entities were generated for *pourpre* than expected by chance. Finally, for the unique response category, the distribution of responses across the semantic themes did not differ between *violet*, *lilas*, and *pourpre* (see Table 9).

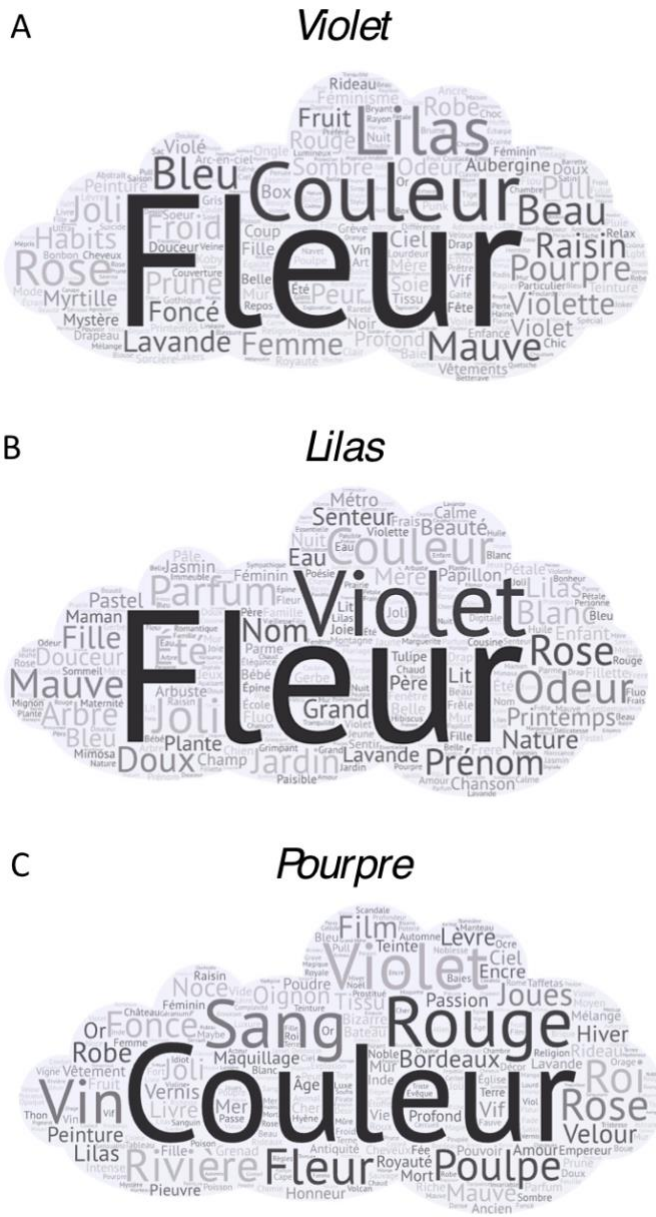


**Figure 1. Discrete responses generated for (A) *violet*, (B) *lilas,* and (C) *pourpre*. Bigger and more central discrete responses were generated more frequently across participants. Note, the scaling is not linear, which means that a response that is twice as large was not necessarily generated twice as frequently.**

**Table 2. Allocations of all responses into the nine semantic themes across the three colour terms in the total response set and separated by country.**

| Themes | All responses together | | Algeria | | France | | Switzerland | |
|---|---|---|---|---|---|---|---|---|
| | Count | % | Counts | % | Count | % | Count | % |
| 1. Sensory and Affective Experiences | 132 $^{l}$*** | 6.35 | 16$^{l}$*** | 4.06 | 26$^{l}$** | 6.25 | 91$^{l}$*** | 7.17 |
| 2. Human-Made Entities | 211 | 10.15 | 46 | 11.68 | 40 | 9.62 | 124 | 9.77 |
| 3. Natural Entities | 574 $^{h}$*** | 27.61 | 117$^{h}$*** | 29.70 | 109$^{h}$*** | 26.20 | 345$^{h}$*** | 27.19 |
| 4. Scenery | 92 $^{l}$*** | 4.43 | 22$^{l}$*** | 5.58 | 16$^{l}$*** | 3.85 | 54$^{l}$*** | 4.26 |
| 5. Abstract Concepts | 139 $^{l}$*** | 6.69 | 29$^{l}$* | 7.36 | 32$^{l}$* | 7.69 | 89$^{l}$*** | 7.01 |
| 6. People | 106 $^{l}$*** | 5.10 | 14$^{l}$*** | 3.55 | 20$^{l}$*** | 4.81 | 76$^{l}$*** | 5.99 |
| 7. Colour Terms | 618 $^{h}$*** | 29.73 | 116$^{h}$*** | 29.44 | 140$^{h}$*** | 33.65 | 363$^{h}$*** | 28.61 |
| 8. Personal Responses | 94 $^{l}$*** | 4.52 | 12$^{l}$*** | 3.05 | 14$^{l}$*** | 3.37 | 55$^{l}$*** | 4.33 |
| 9. Ambiguous Words | 113 $^{l}$*** | 5.44 | 22$^{l}$*** | 5.58 | 19$^{l}$*** | 4.57 | 72$^{l}$*** | 5.67 |
| All themes together | 2079 | 100 | 394 | 100 | 416 | 100 | 1269 | 100 |

*Note.* In the column "All responses together", we calculated the number of responses in the total response set. We indicated if each theme was more or less frequent than expected by chance for all responses together and then, for each country separately. Stars indicate frequencies below (marked with $^{l}$) or above (marked with $^{h}$) the chance level, based on the standardised residuals. * $p \leq .050$, ** $p \leq .010$, *** $p \leq .001$.

**Table 3. Allocations of all responses into the nine semantic themes for *violet*, *lilas*, and *pourpre*.**

| Themes | *Violet* | | *Lilas* | | *Pourpre* | |
|---|---|---|---|---|---|---|
| | Counts | % | Count | % | Count | % |
| 1. Sensory and Affective Experiences | 36 | 5.25 | 73 $^{h}$*** | 10.35 | 22 $^{l}$*** | 3.20 |
| 2. Human-Made Entities | 79 | 11.52 | 39 $^{l}$*** | 5.53 | 92 $^{h}$*** | 13.37 |
| 3. Natural Entities | 186 | 27.11 | 254 $^{h}$*** | 36.03 | 131 $^{l}$*** | 19.04 |
| 4. Scenery | 15 $^{l}$*** | 2.19 | 52 $^{h}$*** | 7.38 | 25 | 3.63 |
| 5. Abstract Concepts | 66 $^{h}$*** | 9.62 | 16 $^{l}$*** | 2.27 | 56 | 8.14 |
| 6. People | 29 | 4.23 | 49 $^{h}$* | 6.95 | 32 | 4.65 |
| 7. Colour Terms | 170 $^{l}$*** | 24.78 | 183 $^{l}$** | 25.96 | 266 $^{h}$*** | 38.66 |
| 8. Personal Responses | 39 | 5.69 | 23 $^{l}$* | 3.26 | 32 | 4.65 |
| 9. Ambiguous Words | 66 $^{h}$*** | 9.62 | 16 $^{l}$*** | 2.27 | 32 | 4.65 |
| All themes together | 686 | 100 | 705 | 100 | 688 | 100 |

*Note.* We indicated whether each theme was more or less frequent than expected by chance when comparing the three colour terms – *violet*, *lilas*, and *pourpre*. Stars indicate frequencies below (marked with $^{l}$) or above (marked with $^{h}$) the chance level, based on the standardised residuals. * $p \leq .050$, ** $p \leq .010$, *** $p \leq .001$.

**Table 4. The number of discrete responses participants gave as associations with the French colour terms *violet*, *lilas*, and *pourpre*.**

| Discrete responses | Criteria applied to the total response set | | | | Criteria applied to each of the colour-specific response sets | | |
|---|---|---|---|---|---|---|---|
| | All terms together | *Violet* | *Lilas* | *Pourpre* | *Violet* | *Lilas* | *Pourpre* |
| Highly frequent | 3 | 3 | 3 | 3 | 3 | 4 | 3 |
| Frequent | 11 | 9 | 10 | 9 | 10 | 10 | 10 |
| Rare | $147^{h}$* | $92^{h}$* | $45^{l}$*** | $96^{h}$* | 54 | $31^{l}$*** | $66^{h}$** |
| Unique | $275^{h}$*** | $127^{h}$*** | $45^{l}$*** | 102 | $164^{h}$*** | $58^{l}$*** | 131 |
| All discrete responses | 436 | $231^{h}$*** | $103^{l}$*** | $210^{h}$** | $231^{h}$*** | $103^{l}$*** | $210^{h}$** |

*Note.* The numbers describe the distribution of discrete responses for the total response set (left part of the table) and for the colour-specific response sets (right part of the table). Stars indicate when frequencies between the three colour terms were significantly lower (marked with $^{l}$) or higher (marked with $^{h}$) than expected by chance. * $p \leq .050$, ** $p \leq .010$, *** $p \leq .001$.

**Table 5. Highly frequent and frequent discrete responses in the total response set and the colour-specific response sets.**

| Across the total response set | | | | | *Violet* response set | | | | | *Lilas* response set | | | | | *Pourpre* response set | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Response | *n* | % | Freq. | Sem. | Response | *n* | % | Freq. | Sem. | Response | *n* | % | Freq. | Sem. | Response | *n* | % | Freq. | Sem. |
| Flower | 333 | 16.02 | HF | 3 | Flower | 104 | 15.16 | HF | 3 | Flower | 215 | 30.50 | HF | 3 | Colour | 89 | 12.94 | HF | 7 |
| Colour | 241 | 11.59 | HF | 7 | Colour | 98 | 14.29 | HF | 7 | *Violet* | 91 | 12.91 | HF | 7 | Red | 78 | 11.34 | HF | 7 |
| *Violet* | 171 | 8.23 | HF | 7 | *Lilas* | 38 | 5.54 | HF | 9 | Colour | 54 | 7.66 | HF | 7 | *Violet* | 74 | 10.76 | HF | 7 |
| Red | 83 | 3.99 | F | 7 | *Pourpre* | 22 | 3.21 | F | 7 | Smell | 36 | 5.11 | HF | 1 | Blood | 34 | 4.94 | F | 3 |
| Mauve | 46 | 2.21 | F | 7 | Mauve | 21 | 3.06 | F | 7 | Fragrance | 25 | 3.55 | F | 2 | Octopus | 16 | 2.33 | F | 3 |
| *Lilas* | 42 | 2.02 | F | 9 | Lavender | 18 | 2.62 | F | 3 | Spring | 22 | 3.12 | F | 4 | Flower | 14 | 2.03 | F | 3 |
| Pink/rose | 40 | 1.92 | F | 9 | Pink/rose | 16 | 2.33 | F | 9 | First name | 22 | 3.12 | F | 6 | Wine | 13 | 1.89 | F | 3 |
| Smell | 39 | 1.88 | F | 1 | Beautiful | 10 | 1.46 | F | 8 | Mauve | 20 | 2.84 | F | 7 | River | 11 | 1.60 | F | 4 |
| Blood | 34 | 1.64 | F | 3 | Woman | 9 | 1.31 | F | 6 | Pink/rose | 15 | 2.13 | F | 9 | Pink/rose | 9 | 1.31 | F | 9 |
| Fragrance | 28 | 1.35 | F | 2 | Blue | 9 | 1.31 | F | 7 | Garden | 14 | 1.99 | F | 4 | Bordeaux | 7 | 1.02 | F | 9 |
| Lavender | 25 | 1.20 | F | 3 | Violette | 8 | 1.17 | F | 3 | Soft | 13 | 1.84 | F | 1 | King | 7 | 1.02 | F | 6 |
| *Pourpre* | 25 | 1.20 | F | 7 | Grape | 8 | 1.17 | F | 3 | Pretty | 11 | 1.56 | F | 8 | Onion | 7 | 1.02 | F | 3 |
| Spring | 25 | 1.20 | F | 4 | Clothes | 7 | 1.02 | F | 2 | White | 8 | 1.13 | F | 7 | Cheeks | 7 | 1.02 | F | 3 |
| First name | 22 | 1.06 | F | 6 | | | | | | Tree | 8 | 1.13 | F | 3 | | | | | |

*Note*. *n* = the number of times each response was generated. % = percentage from the total. Freq. = frequency category; Sem. = semantic theme. Frequency categories were coded as follows: HF = highly frequent; F = frequent; R = rare; and U = unique. We translated the original French responses to English in this table, while we analysed the French responses.

**Table 6. Non-unique responses from the total response set, given as responses for only one colour term.**

| *Violet* | | | | *Lilas* | | | | *Pourpre* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Responses | *n* | Freq. | Sem. | Responses | *n* | Freq. | Sem. | Responses | *n* | Freq. | Sem. |
| Blueberry | 6 | R | 3 | First name | 22 | F | 6 | Blood | 34 | F | 3 |
| Feminism | 4 | R | 5 | Garden | 14 | F | 4 | River | 11 | F | 4 |
| Violated | 3 | R | 9 | Scent | 5 | R | 1 | Cheek | 7 | F | 3 |
| Flag | 2 | R | 2 | Name | 4 | R | 6 | King | 7 | F | 6 |
| Equality | 2 | R | 5 | Pastel | 3 | R | 7 | Make-up | 6 | R | 2 |
| Silk | 2 | R | 2 | Child | 3 | R | 6 | Wedding | 5 | R | 5 |
| Strike | 2 | R | 5 | Plant | 3 | R | 3 | Emperor | 4 | R | 6 |
| Witch | 2 | R | 6 | Song | 3 | R | 2 | Powder | 3 | R | 2 |
| Emo | 2 | R | 5 | Family | 2 | R | 6 | Ink | 3 | R | 2 |
| Box | 2 | R | 2 | Mom | 2 | R | 6 | Octopus | 3 | R | 3 |
| Blanket | 2 | R | 2 | Grandfather | 2 | R | 6 | Winter | 3 | R | 4 |
| Gothic | 2 | R | 5 | Lilac blossom | 2 | R | 3 | Honour | 3 | R | 5 |
| Childhood | 2 | R | 5 | Bush | 2 | R | 3 | I don’t know | 3 | R | 9 |
| Candy | 2 | R | 2 | Good smell | 2 | R | 1 | Antiquity | 3 | R | 5 |
| Sister | 2 | R | 6 | Tulip | 2 | R | 3 | Rich | 2 | R | 5 |
| Night | 2 | R | 4 | Mountain | 2 | R | 4 | Hue | 2 | R | 7 |
| Rainbow | 2 | R | 4 | Metro | 2 | R | 2 | Castle | 2 | R | 2 |

| | | | |
|---|---|---|---|
| Blow | 2 | R | 9 |
| Nails | 2 | R | 3 |
| Particular | 2 | R | 8 |
| Church | 2 | R | 9 |
| Autumn | 2 | R | 4 |
| Lips | 2 | R | 3 |
| Boat | 2 | R | 2 |
| Expensive | 2 | R | 8 |
| Weird | 2 | R | 8 |
| Explosion | 2 | R | 5 |
| Sea | 2 | R | 4 |
| Dark colour | 2 | R | 7 |
| Middle-Age | 2 | R | 5 |
| Noble | 2 | R | 5 |
| Sanguine | 2 | R | 1 |
| Nobleness | 2 | R | 5 |
| Taffeta | 2 | R | 2 |
| Dirt | 2 | R | 3 |
| Ancient | 2 | R | 8 |
| Death | 2 | R | 5 |

*Note*. *n* = the number of times each response was generated. Freq. = frequency category; Sem. = semantic theme. Frequency categories were coded as follows: HF = highly frequent; F = frequent; R = rare; and U = unique. We translated the original French responses to English in this table while we analysed the French responses.

**Table 7. Discrete responses that changed discrete response category based on the total response set and the colour-specific response sets.**

| *Violet* (*n* = 48) | | | | *Lilas* (*n* = 20) | | | | *Pourpre* (*n* = 44) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency increased (*n* = 7) | | Frequency decreased (*n* = 41) | | Frequency increased (*n* = 6) | | Frequency decreased (*n* = 14) | | Frequency increased (*n* = 9) | | Frequency decreased (*n* = 35) | |
| Discrete response | Category change | Discrete response | Category change | Discrete response | Category change | Discrete response | Category change | Discrete response | Category change | Discrete response | Category change |
| *Lilas* | F → HF | *Violet* | HF → R | Smell | F → HF | Lavender | F → R | Red | F → HF | Flower | HF → F |
| Beautiful | R → F | Fragrance | F → R | Garden | R → F | *Lilas* | F → R | Bordeaux | R → F | Fragrance | F → R |
| Blue | R → F | Red | F → R | Pretty | R → F | *Pourpre* | F → U | Cheek | R → F | Lavender | F → R |
| Clothes | R → F | Spring | F → R | Soft | R → F | Red | F → U | Dark | R → F | *Lilas* | F → R |
| Grape | R → F | Smell | F → R | Tree | R → F | Beautiful | F → U | King | R → F | Mauve | F → R |
| Violette | R → F | Ashamed | R → U | White | R → F | Love | F → U | Octopus | R → F | *Pourpre* | F → R |
| Woman | R → F | Beauty | R → U | | | Marriage | R → U | Onion | R → F | Ashamed | F → U |
| | | Beetroot | R → U | | | Mother | R → U | River | R → F | Beautiful | R → U |
| | | Book | R → U | | | Raisin | R → U | Wine | R → F | Beetroot | R → U |
| | | Bordeaux | R → U | | | Romantic | R → U | | | Berry | R → U |
| | | Butterfly | R → U | | | Sheet | R → U | | | Blue | R → U |
| | | Calm | R → U | | | Tranquillity | R → U | | | Clothes | R → U |
| | | Coat | R → U | | | Wall | R → U | | | Coat | R → U |
| | | Film | R → U | | | Warm | R → U | | | Cold | R → U |
| | | Gold | R → U | | | | | | | Eggplant | R → U |

| | |
|---|---|
| Good | R → U |
| Intense | R → U |
| Jasmin | R → U |
| Lipstick | R → U |
| Lively | R → U |
| Majestic | R → U |
| Marriage | R → U |
| Mixture | R → U |
| Mother | R → U |
| Nail polish | R → U |
| Nature | R → U |
| Onion | R → U |
| Passion | R → U |
| Petal | R → U |
| Power | R → U |
| Rape | R → U |
| Satin | R → U |
| Sensuality | R → U |
| Sheet | R → U |
| Fear | R → U |
| Field | R → U |
| Fruit | R → U |
| Girl | R → U |
| Grand-mother | R → U |
| Jumper | R → U |
| Majestic | R → U |
| Mystery | R → U |
| Poison | R → U |
| Rape | R → U |
| Romantic | R → U |
| Satin | R → U |
| Sensuality | R → U |
| Shellfish | R → U |
| Shoe | R → U |
| Soft | R → U |
| Spring | R → U |
| Vampire | R → U |
| Warm | R → U |

| | | | |
|---|---|---|---|
| Shellfish | R → U | White | R → U |
| Shoe | R → U | | |
| Summer | R → U | | |
| Tree | R → U | | |
| Vampire | R → U | | |
| Velvet | R → U | | |
| Wine | R → U | | |

*Note*. We display participant discrete responses that changed frequency category when considering the total response set and comparing it to each of the three colour-specific response sets. In other words, when the total response set was split into three colour-specific response sets, the percentage of response occurrence differed between the three response sets (see section 2.4.2.1). Frequency increased/decreased = higher/lower frequency category when criteria were applied on the responses generated for the given term (i.e., *violet*, *lilas*, or *pourpre,* colour-specific response sets) than when criteria were applied on all the responses (total response set). For instance, the discrete response BEAUTIFUL was a rare response in the total response set, but it was frequent for the term *violet* (coded as R → F) and unique for the term *lilas* (coded as R → U). Frequency categories were coded in the following way: HF = highly frequent; F = frequent; R = rare; and U = unique. For ease of presentation, we translated the original French responses to English for this table. In our actual analysis, we used the original French responses.

**Table 8. The distribution of all responses as a function of semantic theme and frequency category.**

| Semantic theme | Highly Frequent | Frequent | Rare | Unique |
|---|---|---|---|---|
| 1. Sensory and Affective Experiences | 0 [l]*** | 39 | 66 | 27 |
| 2. Human-Made Entities | 0 [l]*** | 28 [l]** | 130 [h]*** | 53 [h]*** |
| 3. Natural Entities | 333 [h]*** | 59 [h]* | 143 [h]*** | 39 |
| 4. Scenery | 0 [l]*** | 25 [l]** | 58 | 9 [l]*** |
| 5. Abstract Concepts | 0 [l]*** | 0 [l]*** | 68 | 71 [h]*** |
| 6. People | 0 [l]*** | 22 [l]*** | 61 | 23 |
| 7. Colour Terms | 412 [h]*** | 154 [h]*** | 41 [l]*** | 11 [l]*** |
| 8. Personal Responses | 0 [l]*** | 0 [l]*** | 63 | 31 |
| 9. Ambiguous Words | 0 [l]*** | 82 [h]*** | 20 [l]*** | 11 [l]*** |

*Note*. Frequency categories were established based on the total response set. We compared the number of responses across the semantic themes for each frequency category separately. Stars indicate the responses which were significantly lower (marked with [l]) or higher (marked with [h]) than expected by chance; * $p \leq .050$, ** $p \leq .010$, *** $p \leq .001$.

**Table 9. The distribution of responses as a function of semantic theme, frequency category, and colour term**

| | Highly Frequent | | | Frequent | | | Rare | | | Unique | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Semantic theme | *Violet* | *Lilas* | *Pourpre* | *Violet* | *Lilas* | *Pourpre* | *Violet* | *Lilas* | *Pourpre* | *Violet* | *Lilas* | *Pourpre* |
| 1. Sensory and Affective Experiences | $0^{l}$*** | $36^{h}$*** | $0^{l}$*** | $0^{l}$* | $13^{h}$*** | $0^{l}$* | 18 | $16^{h}$** | $9^{l}$** | 18 | 8 | 13 |
| 2. Human-Made Entities | 0 | 0 | 0 | 7 | $25^{h}$*** | $0^{l}$*** | 34 | $5^{l}$*** | $70^{h}$*** | 38 | 9 | 22 |
| 3. Natural Entities | $104^{h}$** | $215^{h}$*** | $0^{l}$*** | 34 | $8^{l}$*** | $91^{h}$*** | 28 | $23^{h}$** | $17^{l}$*** | 20 | 8 | 23 |
| 4. Scenery | 0 | 0 | 0 | $0^{l}$*** | $36^{h}$*** | 11 | 8 | $15^{h}$*** | 9 | 7 | 1 | 5 |
| 5. Abstract Concepts | 0 | 0 | 0 | 0 | 0 | 0 | 23 | $4^{l}$** | 31 | 43 | 12 | 25 |
| 6. People | 0 | 0 | 0 | 9 | $22^{h}$** | 7 | $8^{l}$* | $20^{h}$*** | 13 | 12 | 7 | 12 |
| 7. Colour Terms | $98^{l}$*** | $145^{l}$*** | $241^{h}$*** | $52^{h}$*** | 28 | $0^{l}$*** | 16 | 6 | 17 | 4 | 4 | 8 |
| 8. Personal Responses | 0 | 0 | 0 | 10 | 11 | $0^{l}$** | 14 | 4 | 17 | 15 | 8 | 15 |
| 9. Ambiguous Words | $38^{h}$*** | $0^{l}$*** | $0^{l}$*** | 16 | 15 | 16 | 5 | 0 | 8 | 7 | 1 | 8 |

*Note*. Frequency categories were established based on the colour-specific response sets. We compared the number of responses across the three colour terms and the nine semantic themes for each frequency category separately. Stars indicate the responses which were significantly lower (marked with $^{l}$) or higher (marked with $^{h}$) than expected by chance. * $p \leq .050$, ** $p \leq .010$, *** $p \leq .001$.

## 4. Discussion

The colour category PURPLE is inconsistent in the colour space and its meaning. For instance, people disagree about its i) focal colours (Regier et al., 2005; Uusküla & Bimler, 2016); ii) category boundaries (Uusküla, 2007; Uusküla & Bimler, 2016); and iii) emotion associations (Hupka et al., 2016; Jonauskaite, Abu-Akel, et al., 2020; Jonauskaite et al., 2021; Jonauskaite, Parraga, et al., 2020; Uusküla et al., 2023). Intrigued by these observations, and by the existence of different terms for PURPLE, we compared the semantic meaning of the French colour terms *violet* (basic colour term), *lilas* (non-basic colour term), and *pourpre* (non-basic colour term). French speakers in Algeria, France, and Switzerland provided up to three free associations with each of these terms, resulting in 2,079 responses in total. We analysed the occurrences, frequencies, and semantic meanings of these responses.

Overall, our participants produced 436 discrete responses, implying that, on average, each response should have been mentioned around five times. However, that was not the case. Three responses – FLOWER, COLOUR, and *VIOLET* – were highly frequent, each accounting for over 5% of all responses and mentioned at least 100 times. Eleven responses – RED, MAUVE, *LILAS*, PINK/ROSE, SMELL, BLOOD, FRAGRANCE, LAVANDER, *POURPRE*, SPRING, and FIRST NAME – were frequent, each accounting for 1-5% of all responses (i.e., mentioned at least 20 times). The latter responses consisted mainly of words denoting colours, flowers, and related sensory experiences. This observation was in line with the semantic theme analysis (Epicoco et al., 2021), because Natural Entities (which included flowers) and Colour Terms were the most frequent semantic themes overall. From the remaining 422 discrete responses, over half of them were unique, meaning that they had been mentioned only once. Another third of the responses were rare, each mentioned at least twice but no more than 20 times (i.e., 1% of responses). When looking at these response patterns, the associations with three colour terms were broad and diverse. Worth noting, these patterns were comparable for responses from Algeria, France, and Switzerland. Accordingly, previously reported cross-cultural similarities for colour-emotion correspondences (Adams & Osgood, 1973; Jonauskaite, Abu-Akel, et al., 2020; Jonauskaite, Wicker, et al., 2019) also held for the semantic meaning of PURPLE, at least when the French language is concerned.

When going separately into the response sets for *violet*, *lilas*, and *pourpre*, there were some notable differences, even in the highly frequent responses. For instance, FLOWER, a highly frequent response overall, remained highly frequent in the response sets of *violet* and *lilas* but not *pourpre*, for which FLOWER was a frequent but not a highly frequent response. RED was a highly frequent response for *pourpre* only. SMELL was a highly frequent response for *lilas* only. *LILAS* was a highly frequent response for *violet* only. Turning to responses that were present in a single response set, we found that BLUEBERRY, FEMINISM, and EQUALITY were associated with *violet*; BLOOD, RIVER, KING, and CHEEK with *pourpre*, and GARDEN and FIRST NAME with *lilas*. The semantic theme analysis also supported differences in semantic meanings, as different themes were over-represented for *violet* (Abstract Concepts and Ambiguous Words), *lilas* (Natural Entities, Scenery, and People), and *pourpre* (Colour Terms and Human-Made Entities). Thus, the three colour terms evoked different semantic representations and, by conjecture, had different meanings.

Our analyses provided evidence for the basicness status of the term *violet* in French. In other words, we found some indication that *violet* was the superordinate concept to *lilas* and *pourpre,* while the concept COLOUR was superordinate to all three colour terms. This conclusion merits further explanation given the literature on basic and non-basic colour terms (Biggam, 2012) as well as on Rosch's theory of categorization (Rosch, 1978). COLOUR was a highly frequent response for all three terms – *violet* (15%), *lilas* (8%), and *pourpre* (13%). Then, the non-basic terms *pourpre* and *lilas* triggered *VIOLET* as a response, while the basic term *violet* triggered both *POURPRE* and *LILAS* as responses. In contrast, *pourpre* did not trigger *LILAS,* and *lilas* did not trigger *POURPRE* as response. *Violet* also yielded the largest number of unique responses and the largest number of responses belonging to the theme Abstract Concepts. Both observations can be expected when dealing with general concepts, such as basic colour terms (Rosch, 1978). Thus, our results supported the hypothesis that *violet*, as the basic colour term, had the broadest semantic meaning.

Although predicted, we could only partly confirm that the basic term (*violet*) would have the broadest semantic meaning. More specifically, while *lilas* (non-basic) indeed had a narrower semantic meaning than *violet* (basic), on some metrics, *violet* (basic) did not differ from *pourpre* (non-basic). Both *violet* and *pourpre* yielded i) double as many discrete responses as *lilas* and ii) more rare responses than *lilas*. Thus, *lilas* showed the narrowest semantic meaning of the three colour terms, being mainly associated with flowers, gardens, nice smells, and spring. These associations would also fit the plant lilac. Likely, the colour *lilas* and the plant lilac share an important amount of semantic space, because, in French, they are homonyms (i.e., the same word is used for the plant and the colour). When considering the semantic meanings of *violet* and *pourpre*, their spaces did not seem to importantly overlap. *Pourpre* triggered a much greater number of RED responses compared to both *violet* and *lilas,* suggesting that *pourpre* might perceptually correspond to redder shades of colour. In fact, both RED and *VIOLET* were highly frequent responses for *pourpre*, indicating that *pourpre* might fall under the category RED rather than PURPLE for some participants. *Pourpre* also triggered BLOOD, WINE, and BORDEAUX as responses, typically associated with the RED category. In contrast, *lilas* only triggered VIOLET, suggesting that *lilas* falls under the umbrella category of PURPLE. The basic term *violet* triggered both BLUE and RED as responses confirming that basic terms trigger other basic terms (Medin, 1983; Rosch, 1973, 1978). In this specific case, the occurrence of RED and BLUE indicates that *violet* represents the basic colour term for PURPLE, positioned between these two categories in the perceptual colour space.

### 4.1. Limitations and Future Directions

We recruited French speaking participants in Algeria, France, and Switzerland, restricting our semantic analysis to a single language. Results did not differ between these countries, indicating that speakers of the same language have similar semantic spaces, at least for the PURPLE terms. Interestingly, a previous study showing cross-cultural similarities for colour-emotion associations also highlighted the importance of linguistic proximity (Jonauskaite, Abu-Akel, et al., 2020). Most recently, Uusküla et al. (2023) showed the importance of language specifically for PURPLE, because colour-emotion associations were more similar when languages used the same word form (i.e., cognate) for the basic term of PURPLE. That said, in our study, participants lived geographically close, at least in relative terms. Thus, to

distinguish linguistic proximity from geographic proximity, studies should also include French speakers from more distant countries, like Canada, Senegal, or Congo.

To further the purposed importance of linguistic proximity, future studies should also test the semantic meaning of PURPLE in different languages of varying linguistic distance from each other (e.g., see Jäger, 2018). In that case, translation of colour terms should be carefully considered (Uusküla, 2020). For example, if one were to translate the French term *violet* into English, they should not choose *violet* in English, but instead opt for *purple*, because *violet* is the basic term in French while *purple* is the basic colour term in English (Forbes, 2006; Lindsey & Brown, 2014). One could also include both terms in both language (i.e., *violet* and *pourpre* in French, and *violet* and *purple* in English). Then, one could separate the semantic meanings of the basic terms from that of the words with the same etymology (i.e., origin). Put more simply, one could answer whether the French term *violet* would have a similar semantic meaning to the English term *purple* (both basic) or to the English term *violet* (both having the same etymology). Such studies would be informative beyond the semantic meaning of PURPLE, because they would speak for the comparability of the results obtained in different languages and in different parts of the world.

Finally, we worked with colour terms, knowing little about the actual shades of colour participants might have imagined. One could have asked participants to select the actual shades of colour for each colour term and collected free associations. Such a design would give insight into whether the semantic meaning is driven by the colour term, or whether the perceptual representations play a role too. For instance, perhaps those who associated more negative concepts with PURPLE also imagined it to be darker (and darker colours are more negative; Jonauskaite, Parraga, et al., 2020; Valdez & Mehrabian, 1994).

## 5. Conclusions

We investigated whether the different French colour terms for the colour category PURPLE carry different semantic meanings. Analysing semantic content and occurrence of free associations with these terms, we observed that i) the basic colour term *violet* yielded the widest and the most abstract representation, confirming its basicness; ii) the non-basic colour term *pourpre* might be linked to more reddish shades of colour; and iii) the non-basic colour term *lilas* might link semantically to the plant lilac resulting in a narrower semantic meaning. Our analyses also confirmed the hierarchical semantic structure by which the word COLOUR was found to be the superordinate concept, followed by the basic colour term VIOLET, and finally by the two non-basic terms *LILAS* and *POURPRE*. Our approach could now be applied to other languages and other colour terms, in which the basicness of terms needs clarification.

## 6. References


Adams, F. M., & Osgood, C. E. (1973). A Cross-Cultural Study of the Affective Meanings of Color. *Journal of Cross-Cultural Psychology*, *4*(2), 135–156. https://doi.org/10.1177/002202217300400201

Berlin B., & Kay P. (1969). *Basic Color Terms: Their Universality and Evolution*. Berkeley: University of California Press.

Biggam, C. P. (2012). *The semantics of colour: A historical approach*. Cambridge University Press.

Buchanan, L., Westbury, C., & Burgess, C. (2001). Characterizing semantic space: Neighborhood effects in word recognition. *Psychonomic Bulletin & Review*, *8*(3), 531–544.

Chermahini, S. A., & Hommel, B. (2010). The (b)link between creativity and dopamine: Spontaneous eye blink rates predict and dissociate divergent and convergent thinking. *Cognition*, *115*(3), 458–465. https://doi.org/10.1016/j.cognition.2010.03.007

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Routledge Academic.

Epicoco, D., Mohr, C., Uusküla, M., Quiblier, M., Bouayed Meziane, M., Laurent, E., & Jonauskaite, D. (2021). Making sense of free associations with PURPLE - A new coding scheme testing French speakers in three countries. *Proceedings of the International Colour Association (AIC)*, 891–896.

Fitzpatrick, T., Playfoot, D., Wray, A., & Wright, M. J. (2015). Establishing the reliability of word association data for investigating individual and group differences. *Applied Linguistics*, *36*(1), 23–50. https://doi.org/10.1093/applin/amt020

Forbes, I. (2006). Age-related differences in the basic colour vocabulary of French. In C. P. Biggam, K. C, & Pitchfords N.J (Eds.), *Progress in colour studies I. Language and culture* (pp. 101–109). Benjamins.

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Aldine.

Griber, Y. A., Mylonas, D., & Paramei, G. V. (2018). Objects as culture-specific referents of color terms in Russian. *Color Research and Application*, *43*(6), 958–975. https://doi.org/10.1002/col.22280

Hupka, R. B., Zaleski, Z., Otto, J., Reidl, L., & Tarabrina, N. V. (2016). The Colors of Anger, Envy, Fear, and Jealousy: A Cross-Cultural Study. *Journal of Cross-Cultural Psychology*, *28*(2), 156–171. https://doi.org/10.1177/0022022197282002

Jäger, G. (2018). Data descriptor: Global-scale phylogenetic linguistic inference from lexical resources. *Scientific Data*, *5*. https://doi.org/10.1038/sdata.2018.189

Jonauskaite, D., Abu-Akel, A., Dael, N., Oberfeld, D., Abdel-Khalek, A. M., Al-Rasheed, A. S., Antonietti, J. P., Bogushevskaya, V., Chamseddine, A., Chkonia, E., Corona, V., Fonseca-Pedrero, E., Griber, Y. A., Grimshaw, G., Hasan, A. A., Havelka, J., Hirnstein, M., Karlsson, B. S. A., Laurent, E., … Mohr, C. (2020). Universal Patterns in Color-Emotion Associations Are Further Shaped by Linguistic and Geographic Proximity. *Psychological Science*, *31*(10), 1245–1260. https://doi.org/10.1177/0956797620948810

Jonauskaite, D., Camenzind, L., Parraga, C. A., Diouf, C. N., Ducommun, M. M., Müller, L., Norberg, M., & Mohr, C. (2021). Colour-emotion associations in individuals with red-green colour blindness. *PeerJ*, *9*, e11180. https://doi.org/10.7717/PEERJ.11180/SUPP-1

Jonauskaite, D., Parraga, C. A., Quiblier, M., & Mohr, C. (2020). Feeling Blue or Seeing Red? Similar Patterns of Emotion Associations With Colour Patches and Colour Terms. *I-Perception*, *11*(1). https://doi.org/10.1177/2041669520902484

Jonauskaite, D., Wicker, J., Mohr, C., Dael, N., Havelka, J., Papadatou-Pastou, M., Zhang, M., & Oberfeld, D. (2019). A machine learning approach to quantify the specificity of colour–emotion associations and their cultural differences. *Royal Society Open Science*, *6*(9). https://doi.org/10.1098/rsos.190741

Kay, P., & McDaniel, C. K. (1978). The linguistic significance of the meanings of basic color terms. *Language*, *54*(3), 610–646. https://doi.org/10.1353/LAN.1978.003

Kay, P., & Regier, T. (2003). Resolving the question of color naming universals. *Proceedings of the National Academy of Sciences*, *100*(15), 9085–9089. https://doi.org/10.1073/pnas.1532837100

Lindsey, D. T., & Brown, A. M. (2014). The color lexicon of American English. *Journal of Vision*, *14*(2), 17–17. https://doi.org/10.1167/14.2.17

Lothane, H. Z. (2018). Free Association as the Foundation of the Psychoanalytic Method and Psychoanalysis as a Historical Science. *Psychoanalytic Inquiry*, *38*(6), 416–434. https://doi.org/10.1080/07351690.2018.1480225

Majid, A., Jordan, F., & Dunn, M. (2015). Semantic systems in closely related languages. *Language Sciences*, *49*, 1–18. https://doi.org/10.1016/J.LANGSCI.2014.11.002

Medin, D. L. (1983). Structural principles in categorization. *Perception, Cognition, and Development: Interactional Analyses*, 203–230.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: A sourcebook of new methods*. Sage Publications.

Mylonas, D., & MacDonald, L. (2012). Colour naming for colour communication. In *Colour Design: Theories and Applications* (pp. 254–270). Elsevier Inc. https://doi.org/10.1533/9780857095534.2.254

R Core Team. (2022). *R: A Language and Environment for Statistical Computing*.

Regier, T., Kay, P., & Cook, R. S. (2005). Focal colors are universal after all. *Proceedings of the National Academy of Sciences of the United States of America*, *102*(23), 8386–8391.

Rosch, E. (1973). On the internal structure of perceptual and semantic categories. *Cognitive Development and Acquisition of Language*, 111–144.

Rosch, E. (1978). Principle of categorization. *Cognition and Categorization*.

Scherer, K. R., Shuman, V., Fontaine, J. J. R., & Soriano, C. (2013). *The GRID meets the Wheel: Assessing emotional feeling via self-report*. In J. R. J. Fontaine, K. R. Scherer, & C. Soriano (Eds.), Components of emotional meaning: A sourcebook (pp. 281–298). Oxford University Press. https://doi.org/10.13140/RG.2.1.2694.6406

Siew, C. S. Q., Wulff, D. U., Beckage, N. M., & Kenett, Y. N. (2019). Cognitive network science: A review of research on cognition through the lens of network representations, processes, and dynamics. *Complexity*, *2019*. https://doi.org/10.1155/2019/2108423

Sturges, J., & Whitfield, T. W. A. (1995). Locating basic colours in the Munsell space. *Color Research & Application*, *20*(6), 364–376. https://doi.org/10.1002/col.5080200605

Tager, A. (2018). Why Was the Color Violet Rarely Used by Artists before the 1860s?: A Descriptive Summary and Potential Explanation. *Journal of Cognition and Culture*, *18*(3–4), 262–273. https://doi.org/10.1163/15685373-12340030

Uusküla, M. (2007). Basic colour terms of Finnish. *SKY Journal of linguistics*, *20*, 367-397.

Uusküla, M. (2020). Translation of colour terms: An empirical approach toward word-translation from English into Estonian. *Eesti Ja Soome-Ugri Keeleteaduse Ajakiri*, *10*(2), 69–84. https://doi.org/10.12697/jeful.2019.10.2.05

Uusküla, M., & Bimler, D. (2016). How universal are focal colours after all? A different approach and analysis for identifying focal colours. *Color language and color categorization*, 2.

Uusküla, M., Mohr, C., Epicoco, D., & Jonauskaite, D. (2023). Is Purple Lost in Translation? The Affective Meaning of Purple, Violet, and Lilac Cognates in 16 Languages and 30 Populations. *Journal of Psycholinguistic Research*. https://doi.org/10.1007/s10936-022-09920-5

Valdez, P., & Mehrabian, A. (1994). Effects of Color on Emotions. *Journal of Experimental Psychology: General*, *123*(4), 394–409. https://doi.org/10.1037/0096-3445.123.4.394

Witzel, C. (2019). Misconceptions About Colour Categories. *Review of Philosophy and Psychology*, *10*(3), 499–540. https://doi.org/10.1007/s13164-018-0404-5

## 7. Short author biographies

**Déborah Epicoco** is a doctoral student in experimental colour psychology. Her studies are based on validated approaches, designed to understand how people cognitively and affectively relate to colour. She is currently at the University of Lausanne, Faculty of Social and Political Sciences, Institute of Psychology, in Switzerland.

**Prof. Christine Mohr** is a full professor for Cognitive Psychology at the University of Lausanne. After having acquired some research experience on synaesthesia, she started to focus on the relationships between colour and affect, with a second interest for the psychological mechanisms of irrational beliefs (e.g., the paranormal, superstitions).

**Dr. Mari Uusküla** is a psycholinguist, interested in the interaction of perception and language, working on colour naming and perception in many European languages. She is an Associate Professor of Linguistics and Translation Theory at Tallinn University, School of Humanities, and Head of Department of Western European Studies at the same university.

**Michael Quiblier** works as a research assistant at the Institute of Psychology, University of Lausanne, Switzerland, exploring psychological connotations of colours, with a special interest on preferences and emotions. He holds a BSc and his pursing an MSc degree on Work and Organizational Psychology, from the University of Neuchâtel, Switzerland.

**Dr. Maliha Khadidja Bouayed Meziane** works in sociolinguistics and teaches English as a foreign language in link with technology and how the attitudes and behaviour of students are, in different contexts. She is currently a lecturer at Ecole Nationale Polytechique, School of Engineering, Laboratoire de Génie Sismique et Dynamiques des Structures, Algiers, Algeria.

**Dr. Eric Laurent** works at developing an enactive/embodied/situated cognition framework in psychology, with a special interest in normal mood and depressive disorders. He also teaches cognitive psychology as an Associate Professor in the Department of Psychology at the University of Franche-Comté, Besançon, France.

**Giulia F.M. Spagnulo** was exploring psychological and affective connotations of colours as a research assistant at the Institute of Psychology, University of Lausanne, Switzerland. Giulia

holds an MSc degree in Psychology and is currently pursuing a PhD degree in Psychology, specialising on couples and familial relationships.

**Dr. Domicele Jonauskaite** is an experimental psychologist, studying cognitive and affective connotations of colour. She examines associations with colours across cultures and individuals and conducts research in aesthetics and art. Dr. Jonauskaite is currently a Senior Research Fellow at the Institute of Psychology, University of Lausanne, Switzerland.

## 8. Appendix

### 8.1. Development of the coding scheme

To identity recurrent themes in free associations, we used "open coding" found in grounded theory (Glaser & Strauss, 1967), but also "clustering" or "theme identification" as referred to in more eclectic approaches (Miles & Huberman, 1994). First, three co-authors (DE, DJ and MQ) defined six themes from the raw data: i) Sensory Experience, ii) Emotion, iii) Concrete Items, iv) Nature, v) Abstract Concepts, and vi) Personal. Unfortunately, these themes were insufficient to group all the free associations. Some free associations were bundled in one theme (e.g., Nature) and others were not codable in this format (e.g., the singer Prince). In the next step, we eliminated some themes and introduced new ones, following the coding scheme by Griber and colleagues, 2018). We ended up with six new themes: i) Experiential (Sensory and Affective experiences), ii) Human-Made Objects, iii) Non-Human-Made Objects, iv) Abstract Concepts, v) Colour Terms, and vi) Personal. DE and MQ independently coded 156 free associations, achieving an almost perfect inter-rater agreement, $\kappa$ = 0.888. However, most free associations were again allocated to two main themes: Abstracts Concepts (37.24%) or Natural Objects and Elements (32.90%). Evidently, the coding scheme still lacked precision. In a final step, we introduced two major modifications, by developing more precise themes and adding subthemes.

In detail, we added three other themes, for a total of nine major themes. Seven of them comprised subthemes (see Table 1). Subthemes for five themes followed Rosch's (1978) categorisation principles, a taxonomy on three levels, used as a system. Each subtheme is related to one another by means of class inclusion. The first one, Superordinate level, is the most abstract. Member of this level only share a few attributes amongst each other (e.g., furniture, vehicle). Second, the Basic level is the most inclusive one, with attributes common to all or most member of the themes. Everyday words usually appear here (e.g., chair, car). And third, the Subordinate level, has characteristics and functions common to objects found in the basic level. Very specific words appear her (e.g., kitchen chair, Porsche).

The themes following Rosch's categorisation are: i) Sensory and Affective Experiences, ii) Human-Made Entities, iii) Natural Entities, iv) People, and v) Colour Terms. The theme Scenery was separated into i) Concrete, and ii) Abstract. The theme Personal Responses was separate into i) Opinions, and ii) Autobiographical Responses. DE and MQ coded another 156 of the participants' responses. They achieved again a very high inter-rater agreement ($\kappa$ = 0.848), indicating consistency in the coding scheme. DE coded the remaining data with final disagreements solved through discussion.

**Table A1. Allocations of all responses into the nine semantic themes for Algeria, across the three colour terms.**

| Themes | All colour terms together | | *Violet* | | *Lilas* | | *Pourpre* | |
|---|---|---|---|---|---|---|---|---|
| | Count | % | Counts | % | Count | % | Count | % |
| 1. Sensory and Affective Experiences | 16 | 4.06 | 6 | 4.54 | 8 | 5.93 | 2 | 1.57 |
| 2. Human-Made Entities | 46 | 11.68 | 14 | 10.60 | 12 | 8.89 | 20 | 15.75 |
| 3. Natural Entities | 117 | 29.70 | 42 | 31.81 | 55 | 40.74 | 20 | 15.75 |
| 4. Scenery | 22 | 5.58 | 5 | 3.87 | 9 | 6.67 | 8 | 6.30 |
| 5. Abstract Concepts | 29 | 7.36 | 9 | 6.80 | 7 | 5.18 | 13 | 10.24 |
| 6. People | 14 | 3.55 | 2 | 1.50 | 7 | 5.18 | 5 | 3.94 |
| 7. Colour Terms | 116 | 29.44 | 39 | 29.53 | 30 | 22.22 | 47 | 37.01 |
| 8. Personal Responses | 12 | 3.05 | 8 | 6.06 | 2 | 1.49 | 2 | 1.57 |
| 9. Ambiguous Words | 22 | 5.58 | 7 | 5.29 | 5 | 3.70 | 10 | 7.87 |
| All themes together | 394 | 100 | 132 | 100 | 135 | 100 | 127 | 100 |

**Table A2. Allocations of all responses into the nine semantic themes for France, across the three colour terms.**

| Themes | All colour terms together | | *Violet* | | *Lilas* | | *Pourpre* | |
|---|---|---|---|---|---|---|---|---|
| | Count | % | Counts | % | Count | % | Count | % |
| 1. Sensory and Affective Experiences | 26 | 6.25 | 4 | 2.96 | 19 | 13.29 | 3 | 2.17 |
| 2. Human-Made Entities | 40 | 9.62 | 14 | 10.37 | 9 | 6.29 | 17 | 12.32 |
| 3. Natural Entities | 109 | 26.20 | 37 | 27.41 | 53 | 37.07 | 19 | 13.77 |
| 4. Scenery | 16 | 3.85 | 2 | 1.49 | 6 | 4.19 | 8 | 5.80 |
| 5. Abstract Concepts | 32 | 7.69 | 12 | 8.89 | 3 | 2.10 | 17 | 12.33 |
| 6. People | 20 | 4.81 | 8 | 5.93 | 9 | 6.29 | 3 | 2.17 |
| 7. Colour Terms | 140 | 33.65 | 39 | 28.89 | 36 | 25.17 | 65 | 47.10 |
| 8. Personal Responses | 14 | 3.36 | 6 | 4.44 | 5 | 3.50 | 3 | 2.17 |
| 9. Ambiguous Words | 19 | 4.57 | 13 | 9.62 | 3 | 2.10 | 3 | 2.17 |
| All themes together | 416 | 100 | 135 | 100 | 143 | 100 | 138 | 100 |

**Table A3. Allocations of all responses into the nine semantic themes for Switzerland, across the three colours terms.**

| Themes | All colour terms together | | *Violet* | | *Lilas* | | *Pourpre* | |
|---|---|---|---|---|---|---|---|---|
| | Count | % | Counts | % | Count | % | Count | % |
| 1. Sensory and Affective Experiences | 91 | 7.17 | 27 | 6.44 | 46 | 10.78 | 18 | 4.26 |
| 2. Human-Made Entities | 124 | 9.77 | 53 | 12.65 | 19 | 4.45 | 52 | 12.29 |
| 3. Natural Entities | 345 | 27.19 | 107 | 25.54 | 145 | 33.96 | 93 | 21.98 |
| 4. Scenery | 54 | 4.26 | 8 | 1.91 | 37 | 8.66 | 9 | 2.13 |
| 5. Abstract Concepts | 89 | 7.01 | 46 | 10.98 | 9 | 2.11 | 34 | 8.04 |
| 6. People | 76 | 5.99 | 19 | 4.53 | 33 | 7.73 | 24 | 5.67 |
| 7. Colour Terms | 363 | 28.61 | 92 | 21.96 | 117 | 27.40 | 154 | 36.41 |
| 8. Personal Responses | 55 | 4.33 | 21 | 5.01 | 13 | 3.04 | 21 | 4.96 |
| 9. Ambiguous Words | 72 | 5.67 | 46 | 10.98 | 8 | 1.87 | 18 | 4.26 |
| All themes together | 1269 | 100 | 419 | 100 | 427 | 100 | 423 | 100 |

**Table A4. The number of discrete responses participants gave as association per country, namely Algeria, France, and Switzerland**

| Discrete responses | Algeria | | | | France | | | | Switzerland | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All terms together | *Violet* | *Lilas* | *Pourpre* | All terms together | *Violet* | *Lilas* | *Pourpre* | All terms together | *Violet* | *Lilas* | *Pourpre* |
| Highly Frequent | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Frequent | 13 | 9 | 8 | 11 | 14 | 9 | 8 | 6 | 8 | 6 | 5 | 6 |
| Rare | 25 | 11 | 11 | 12 | 28 | 16 | 9 | 15 | 106 | 61 | 37 | 64 |
| Unique | 101 | 32 | 20 | 50 | 86 | 38 | 11 | 37 | 203 | 101 | 35 | 70 |
| All discrete responses together | 142 | 55 | 42 | 76 | 131 | 66 | 31 | 61 | 320 | 171 | 80 | 143 |

*Note*. Frequency calculations based on all discrete words given in that country for *violet, lilas* and *pourpre.*