

Feeling blue?

The influence of colour idioms on the perceived emotional valence of emotionally ambiguous facial expressions

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Preface

In front of you lies the thesis “Feeling blue? The influence of colour idioms on the perceived emotional valence of emotionally ambiguous facial expressions”, which I have written during the months March until July 2022.

As a student Linguistics, I have always been interested in the psycho- and neurological aspects of language. How does one learn a language? How does stuttering occur? Does the language you speak influence your view on certain aspects: like counting? In high school I formerly wanted to investigate something very complex in the field of language psychology. My supervisor then, told me that is somewhat challenging for a high school level and advised me to investigate that during my Bachelor. So here I am. Investigating language in a sense of psychology, just like I always wanted to.

During my course Language and Thought, students were required to write a research proposal. I focused on a possible effect of colour idioms on colour-emotion associations that speakers of English and Arabic might have. This course was taught by Dr. Laura Speed, who contacted me at the end of the semester to convey her interest and curiosity about the possible outcomes of the study I outlined in my research proposal. She offered me a spot as one of her Bachelor students to write my thesis under her supervision. I felt honoured and I was excited to start on my thesis.

Therefore, I would love to thank Dr. Laura Speed, my supervisor, for her unconditional support, flexibility and optimism. I have felt very supported and I knew I could always come to her for help. We had a shared enthusiasm for this study and she always had a suggestion ready for a related paper I could read or another option I could try in case I got stuck. The past few months, I have learned a lot and I can say I really improved my academic skills.

I also want to thank Dr. Saskia van Putten, for accepting my request to be my second reader and taking the time to read and assess this thesis.

In addition, I am thankful for everyone who filled in the questionnaire and shared it on social media platforms. Without them, I probably would not have been able to find more than 100 participants in just two weeks’ time. Lastly, I want to thank my partner, my friends and family for always believing in me, being a part of this study when needed and supporting me.

I hope you enjoy reading my thesis, as much as I enjoyed investigating:

The influence of colour idioms on the perceived emotional valence of emotionally ambiguous facial expressions

Jenna Slegt

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Abstract

Colour idioms are characteristic expressions whose meaning cannot be understood from the words used in the expression (Alotaibi, 2020). These can be used to express emotionality (Kemertelidze & Griorgadze, 2021), intensify speech and increase the impact of the message (Malá, 2003). Much research has been done on colour idioms in other languages, but Dutch colour idioms have not yet been explored. Earlier literature in colour psychology has shown that colour seems to evoke positive and negative associations and that these associations enhance the perception of positive and negative emotions. But what happens if emotionally ambiguous facial expressions are rated on emotional valence, and do colour idioms as a function of language, play a role in this process? This study contains a qualitative approach on colour idiom and their valence. Furthermore, it reports an experiment in which 109 participants do a task in which stimuli are rated on their emotional valence. This involves stimuli expressing ambiguous emotions (surprise and neutrality), combined with positive and negative coloured backgrounds. A direct effect of language is tested through verbal interference. Results showed that colour has an effect on perceived emotionally ambiguous emotions and hereby confirms claims of earlier research. However, neither language, nor idiom familiarity, were found to have an effect on perceived valence of emotions. This might suggest that colour idioms strengthen pre-existing colour associations.

Keywords: colour idioms, colour associations, facial expressions, emotional valence.

1. Introduction

Do people who speak Spanish have a different perception of reality than people who speak a tribal language, like Hopi? According to the linguistic relativity theory (also called Sapir-Whorf Hypothesis), this is true. The Sapir-Whorf hypothesis predicts that language systems influence cognition of its speakers (Majid, 2018). Hence, the linguistic system that one uses in their mother tongue influences the way one classifies, perceives and experiences entities in the outside world (Regier & Yang Xu, 2017). There are two approaches to linguistic relativity: structure-centered approach and domain-centered approach (Majid, 2018). A structure-oriented approach looks at linguistic structures and their possible cognitive effects. An example of a structure-centered approach, is that speakers of tonal languages like Cantonese have shown to excel in discriminating pitch and perceiving melody than other, not tone-oriented languages, like English (Bidelman, Hutka & Moreno, 2013).

Unlike the structure-centered approach, the domain-centered approach is related to experiences like colour, space, motion and sound, and how a language categorizes and perceives such a domain. For example, colour language can lead to differences in colour perception. This was shown in a study that investigated the perception of colour in Berinmo and English (Roberson, Davies & Davidoff, 2000). Berinmo appears to group different contiguous areas of the colour space together than English. This causes colour boundaries to be different in Berinmo, in comparison to English: English uses a colour boundary between blue and green, whereas Berinmo does not. Berinmo distinguishes yellow-green shades (called 'wor') from green(-blue) shades (called 'nol').

In one of the experiments of Roberson et al. (2000), speakers of English and speakers of Berinmo did a two-alternative forced choice task. In this task, native speakers of English and Berinmo were shown a target stimulus in a certain shade of colour, and then shown two test stimuli (A & B) in two different shades of colours after a delay. One of the test stimuli belonged the same colour category in at least one of the studied languages. Participants had to select the target stimulus from the two shades of colours from their memory. Results showed that both speakers performed better in their colour memory during between-category conditions compared to within-category conditions. This means that Berinmo speakers were better in memorizing the target colour in conditions where the target stimulus would be e.g. 'nol', and one shade that exists within the colour boundaries of 'wor' compared to two shades of 'nol'. English speakers would respond arbitrarily in this same condition, as this language does not

distinguish these shades of colours into different colour categories. English speakers would therefore score better in conditions where the target stimulus would be e.g. 'blue', and the test stimuli would be 'blue' and 'green' in comparison to two shades of 'blue'. In that situation, Berinmo speakers would then score arbitrary, because they group green and blue shades under the colour term 'nol'.

Roberson et al. (2000) found an effect of language influencing colour memorization, but there was no clear evidence for language playing a direct role during the task. Therefore Roberson and Davidoff (2000) replicated Roberson et al. (2000) and added a verbal interference task. Interference tasks can be added to see if executive functions might be a helpful tool or if they increase cognitive load. By saturating the language centres in the brain (e.g. repeating digit strings), participants are disabled from using language as a tool during the colour task. By comparing the results in this condition to the control condition, one can see if language is helpful for doing the experiment. Participants in Experiment 1 of Roberson and Davidoff (2000) either did a visual interference task, a verbal interference task or no interference task. In interference conditions participants do a dual task to test whether executive functions are useful when responding to stimuli in the experiment. With visual interference, one can investigate whether visual coding is helpful during the dual tasks. Visual interference was accomplished through tracking a colour-dotted string with their eyes and verbal interference was done by reading aloud colour words. The experimental task was the same as in Roberson et al. (2000), but then only for English. Results replicated the findings of earlier research that scores on between-category stimuli pairs improved accuracy in comparison to within-category stimuli pairs, except for those in the verbal interference condition. Visual and verbal interference deteriorated the accuracy in responses to the task, indicating that executive functions are employed during the task. However, in contrast with the visual interference condition, the verbal interference condition removed the between-category advantage. This shows that colour categorisation is stemming from language. In conclusion, between-category responses seem to be more accurate when language helps out (Roberson & Davidoff, 2000). A similar speeded colour discrimination task by Winawer et al. (2007) supported the results Roberson and Davidoff (2000) with a comparison between Russian's colour terms for light blue ('goluboy') and dark blue ('siniy) and English, which does not make this distinction in colour terms. Their results showed that speakers of Russian had an advantage over speakers of English.

Colour language is not only used to describe colours, but also for stylistic reasons: through colour idioms, for example. Idioms can be defined as a characteristic expression that cannot be

understood from the individual meanings of its elements (Alotaibi, 2020). For example, 'I am feeling under the weather' does not mean that someone is literally feeling under the weather. This person is just indicating that he or she feels ill. Colour idioms are idioms that contain a colour designating word (Kemertelidze & Giorgadze, 2021) which have a metaphorical nature (Maksimovna, 2016). An example of a colour idiom is 'white lies', meaning a lie that is told to not hurt someone's feelings. Colour idioms are not only a linguistic representation of a certain language but also a cultural representation (Kemertelidze & Giorgadze, 2021; Rakhieh et al., 2014) e.g. 'Hij zal zijn handen er niet blauw aan tellen' ('He will not count his hands blue') as a reference for the blue bills of ten guilder (former currency of the Netherlands). Colour idioms can also be derived from symbolic associations of the surroundings (Václavíková, 2010), e.g. 'yellow dirt', which means money and refers to the yellow colour of coins. From a study that investigated stylistic use of idioms in mass media, the use of colour idioms intensifies speech, enhances the verbal impact of speech and increases interest of the message (Malá, 2003). Furthermore, colour idioms can serve as a tool to express emotionality in speech and text (Kemertelidze & Giorgadze, 2021).

Colour in colour idioms seem to derive from symbolic associations that exist for each colour (Václavíková, 2010). Studies in English colour psychology have shown that green is experienced as one of the most positive colours (Elliot & Maier, 2012; Gil & Le Bigot, 2015; Kaya & Epps, 2004; Kuhbandner & Pekrun, 2013) as it is associated with growth and nature and evokes feelings of calmness and happiness. The opposite of green in the colour spectrum is red. Red is associated with negativity (Sivananthan, de Lissa & Curby, 2021), as it conveys feelings of anger (Buechner, Maier, Lichtenfeld & Schwarz, 2014) and facilitates the identification of anger from resembled facial configurations (Young, Elliot, Feltman & Ambady, 2013). This red-negativity effect is also visible in language: Kuhbandner and Pekrun (2013) found that negative words were memorized more easily when they were seen in red font compared to green, while positive words were memorized more easily in a green font compared to red.

Studies in colour psychology have shown that black is perceived as one of the most negative colours as it is associated with evil and darkness in English as well as Arabic (Alotaibi, 2020; Kaya & Epps, 2004). Also blue is mostly perceived negatively in English: when feeling sad or ill, skin turns pale. Alkawaz et al. (2015) found that blue skin colour from paleness is derived from oxygen-poor blood that turns skin pale. In contrast to black and blue, pink is associated with positivity, being associated with sweetness and love (Gil & Le Bigot, 2014). Gold is also

perceived positively, relating to feelings of value and beauty in English and Arabic (Alotaibi, 2020; Kaya & Epps, 2004). Lastly, white also has positive connotations due to connotations with purity, innocence and light in Arabic, Georgian and English (Alotaibi, 2020; Gil & Le Bigot, 2014, Kemertelidze & Giorgadze, 2021). However, these studies have been conducted for English, Georgian or Arabic. Rakhieh et al. (2014) found that colour associations - and therefore also colour idioms – may be dependent on culture, too. This means that the associations made with colours might differ in another language.

Colour associations can also have an effect on the perceived emotional valence of facial expressions. According to the green-positivity effect, one associates green with positive aspects - like nature, growth and happiness or a green traffic light (Kaya & Epps, 2004; Kuhbandner & Pekrun, 2013). This might imply that green will make entities look more positive, so emotions might also be perceived more positively in green. In contrast, an earlier explained red-negativity effect means that red has negative connotations – the colour of blood and arousal (Alkawaz et al., 2015; Kaya & Epps, 2004). This can be explained by the high amount of oxygen-rich blood that flows to the face when aroused (Alkawaz et al., 2015). This makes the face seem red. As a result, red connotes with negative judgments (Bazley, Cronqvist & Mormann, 2017).

Research of Sivananthan, de Lissa and Curby (2021) showed that participants rate ambiguous faces more positively when accompanied with a green background compared to a grey or red background. Conversely, participants rate ambiguous faces more negatively when accompanied with a red background compared to a grey or green background. Ambiguous faces are faces expressing neutrality or surprise. Surprise can be positive, e.g. when someone unexpectedly finds flowers at their door, but can also be experienced negatively, e.g. when you find out someone broke into your house. When response time was manipulated (short versus long), both a red-negativity effect and a green-positivity effect were found in a shorter decision condition. This implies that colour effects are rapid and implicit (Elliot & Maier, 2012), because they occur even when processing and decision time are constrained.

Sivananthan et al. (2021) and Gil & Le Bigot (2014) have shown that colour associations seem to influence perceived valence of emotionally ambiguous and non-ambiguous facial expressions. Furthermore, colour associations are present in language and expressed in colour idioms. Colour associations also seem to help memory for positive and negative words (Kuhbandner & Pekrun, 2013). Saysani, Corballis and Corballis (2021) found that blind people, who have not had any visual experience in their life, make the same colour associations as sighted people. Blind people likely learn these colour associations through language, more

specifically through colour-adjective relationships. The question that arises is whether colour idioms might influence emotional valence.

The current study attempts to answer this question in two steps. The first step is collection of Dutch colour idioms and investigation on their valence. Since there is not much published literature on Dutch colour idioms, this study contributes to the research field on colour idioms in Dutch and links this to earlier literature in colour psychology.

The second part of the study aimed to find whether colours used in colour idioms affect the perceived emotional valence of ambiguous facial expressions (neutral vs surprised) through a direct effect of language. Participants were primed with a familiarity task in which they rated idioms (including colour idioms) on their familiarity. Then followed a rating task for emotional valence. During the task, participants are asked to rate blurred ambiguous faces (neutral and surprised) and non-ambiguous faces (happy and sad) on a seven-point Likert scale of emotional valence. To check whether language has a direct effect on perceiving emotional valence, participants were divided into one of three interference conditions: no interference, visual interference, verbal interference.

Roberson and Davidoff (2000) showed that language creates an advantage in tasks for colour categorisation: when the mother tongue categorised the two colour options in two different colour categories, memorisation of the colour was facilitated. During verbal interference, this between-category advantage disappeared. When language would be used as a tool during an emotional rating task, the possible facilitating effect of colour would be removed during verbal interference. Language faculties in the brain would be over-saturated and facilitation through (colour) language could not be possible. During verbal interference, positive coloured backgrounds would then not result into more positive ratings and negative coloured backgrounds in more negative ratings. This would result in more 'neutral' ratings during verbal interference.

The theoretical overview that is presented in this section leads to the following research question and hypotheses:

Research question: To what extent do Dutch colour idioms influence the perceived emotional valence of facial expressions in Dutch native speakers?

Hypothesis 1: There will be a difference in emotional valence between stimuli with positive and negative coloured backgrounds: negative colour backgrounds evoke more negative ratings than positive coloured backgrounds and vice versa.

Hypothesis 2: Scores in the verbal interference condition will show more neutral ratings for ambiguous faces on the scale of valence in comparison to scores during visual interference and without interference.

2. Method

2.1 General method

The aim of this study was to investigate to what extent colour idioms influence the perception of emotional valence in ambiguous facial expressions, specifically Dutch colour idioms in native speakers of Dutch. In order to find an answer to this question, two studies were done. Study 1 aimed to give an overview of existing Dutch colour idioms and their valence. From the results from Study 1, positively and negatively associated colours were selected for an experiment, which is conducted in Study 2. This second study investigated whether perceived emotional valence is affected by the colour of the background (in either a positively or negatively associated colour) in ambiguous facial expressions (surprise and neutral). The objective of these studies is to find a link between the colour associations derived from colour idioms and its influence on perceived emotional valence.

2.2 Study 1: Dutch colour idioms and their associations

2.2.1 Instruments

Colour idioms were collected from two different expression dictionaries (Spreekwoordenboek in zes talen: Nederlands, Frans, Duits, Spaans, Latijn by Cox, Cox-Leick, Hannay & Hiemstra, 1992; Spreekwoordenboek: Nederlands, Fries, Afrikaans, Engels, Duits, Frans, Spaans en Latijn by Cox, et al., 2000), three different encyclopaedia sites (woorden.org, Wikipedia and Spreekwoorden-en-gezegden.nl) and from the Idiomatic Second Language Acquisition (ISLA) database (Hubers et al., 2018). The collection of colour idioms was turned into an overview.

2.2.2 Procedure

The valence of all colour idioms were identified and labelled positive, neutral or negative. The valence rating was based on the positive, neutral or negative role of the colour within the idiom.

The choice of the idioms and their rated valence were discussed with three native speakers of Dutch.

It is important to note that the colour's valence can differ from the overall valence of the idiom. For example, *het gras is altijd groener bij de burens* ('The grass is always greener at the neighbours'), means other people's lives always seem to be better. This idiom itself has a negative meaning, because the comparison one makes to another is not accurate and evokes negative thoughts and feelings. However, the role of green in the idiom is positive: the greener the grass looks, the more beautiful.

After labelling the colours in idioms on their valence, the colour idioms were counted. The associations were further investigated with literature from the colour psychology field and Dutch etymology to find background on these associations.

2.2.3 Results

All colours in the idioms were collected and labelled positive, neutral or negative. The proportion of each colour's positive, neutral and negative meaning in colour idioms were counted and are depicted in Table 1.

Table 1. The distribution of positive, neutral and negative colour idioms in Dutch

	Red	Yellow	Green	Blue	White	Black	Gold	Pink
Positive	4	0	7	4	9	0	27	2
Neutral	6	1	6	6	3	1	3	0
Negative	8	3	3	9	4	21	1	0
Total	18	4	16	19	18	22	31	2

Table 1 shows that black, yellow, red and blue, were most negatively associated in colour idioms. Pink, gold, white and green were most positively associated in colour idioms.

2.2.4 Discussion

Colours removed from the analysis: black, white, gold and yellow.

While black stands out most in the negatively associated colours in colour idioms and white belongs to most positively associated colours in colour idioms, both are removed from the experiment. In contrast with black, blue and red are visible when using a mobile device or laptop in night view. Yellow and gold are too much alike in colour, hence the absence of these

colours in Study 2. Since white is invisible in day view on mobile devices and laptops, only green and pink are selected as positive colours.

Negative colours: blue and red

Blue has different kinds of associations. Blue was also formerly defined as meaninglessness (e.g. ‘een blauwe maandag’ / ‘a blue Monday’) in Dutch (Onze Taal, 2011). Nowadays, many associations of blue in Dutch colour idioms are related to paleness (e.g. ‘staan te blauwbekken’ / ‘standing in awe’). Alkawaz et al. (2015) found that this association derives from oxygen-poor blood, which turns skin pale. Other associations with blue are bruises (e.g. ‘iemand bont en blauw slaan’ / ‘hit someone black and blue’), which associates with the outcomes of being hit: ‘bloody and blue’ (van der Meulen, 1926). Red is often associated with turning red during shame (e.g. ‘het schaamrood op de kaken’ / ‘the shame on the jaws’). Van Wyk (2003) described this association in Dutch idioms as one’s face and neck turning red when someone is ashamed. One also turns red when feeling angry (e.g. ‘zo rood worden als een kalkoense haan’ / ‘become as red as a turkey’). Alkawaz et al. (2015) supports this association with their findings that oxygen-rich blood turns the skin red. This is mostly during emotions with high arousal, like anger and shame.

Positive colours: pink and green

The results in Table 1 show that pink carries only positive colour idioms, being associated with love and sweetness in English (e.g. ‘door een roze bril kijken’ / ‘looking through rose-tinted glasses’) (Gil & Le Bigot, 2014). The Dutch colour idioms that report the colour pink, refers to optimism and is derived from English and French expressions (ENG: ‘looking through rose-tinted glasses’, FR: ‘voir travers des lunettes rose’) (Beelen and van der Sijs, 2016; de Coster, 2020). Green has been shown to have positive associations too, relating to nature and growth in English and Arabic (Alotaibi, 2020; Gil & Le Bigot, 2014; Kaya & Epps, 2004; Sivanthan et al., 2021; Young et al., 2013).

In conclusion, the negative colours that are used in this study are blue and red and the positive colours in this study are pink and green.

2.3 Study 2: Perceived emotional valence of ambiguous facial expressions

In Study 2, an experiment is conducted to investigate the influence of background colours on perceived emotional valence of ambiguous facial expressions, based on the colours blue and red (negative colours) and pink and green (positive colours), and the effect of verbal and visual interference on this possible influence.

2.3.1 Subjects

Out of 157 participants, 43 participants did not finish the experiment and 5 participants guessed the aim. These participants were deleted from the data. The final sample consisted of 109 participants (23 male, 83 female, 3 other), between the age of 18 to 66 ($M: 25,51$, $SD: 1,01$). These participants had an educational level ranging from VMBO to WO (VMBO: 1, HAVO: 4, VWO: 12, MBO: 11, HBO: 17, WO: 61), with 3 people indicating their educational level as 'other'. The interference groups did not differ in gender ($\chi^2(4) = 8,52$, $p = 0.074$) and educational level ($\chi^2(12) = 8.903$, $p = 0.711$). In addition, a one-way ANOVA did not show a significant difference in age across the no interference condition ($M: 23.13$, $sd: 7.31$), the visual interference condition ($M: 27,51$, $sd: 12.70$) and the verbal interference condition ($M: 26$, $sd: 11.22$) ($F(2, 108) = 1.720$, $p = 0.184$, $\eta^2 = 0.03$).

Participants were collected via convenience sampling and network sampling in the span of two weeks. Only native speakers of Dutch were allowed to join the experiment. Native speakers are those who started learning Dutch before the age of 14 (Lenneberg, 1967). With this criterion, age of acquisition and language proficiency were ruled out. Another criterion for participants to join is the minimum age of 18 years old as this is the legal age of consent.

2.3.2 Materials

As a first task, participants rated 28 idioms on their familiarity. The distribution in colour was as follows: five of 'blue', five of 'red', five of 'green' and two of 'pink'. The colour idioms were deducted from Study 1, The other 11 idioms did not include a colour word and were used as fillers. These fillers were retrieved from the ISLA database (Hubers et al., 2018)

Faces for facial expressions were taken from the Radboud Faces Database (RaFD) (Langner et al., 2010). This database consists of 67 models, representing Caucasian adults and children (both male and female) and Moroccan Dutch males who express seven emotions: anger, fear, happiness, disgust, sadness, surprise and contempt. There is also a neutral expression available for each model. One Caucasian adult male and one Caucasian female model were used for both the practice and the experimental session in this study, to avoid an advantage in identifying emotion on one of the genders. The male and female model used in the practice session differs from the models in the test session, to get the participants familiar with the emotions displayed, but to avoid a repetition effect of seeing the same stimuli in both the practice session and test session. The sex of the model was equally distributed over the stimuli. Only surprised and neutral expressions are used as target stimuli. The facial expression for happiness and anger were used as fillers, as in Sivananthan, et al. (2021). Each participant saw the same stimuli.

The colours used in the experiment are red (#FF0000), green (#00FF00), blue (#0000FF) and pink (#FFC0CB). These colours are used as background for the facial expressions that were shown to the participants, and were edited behind the models' faces in Photoshop (Adobe Systems Inc., San Jose, CA, USA) into stimuli for the experiment. The facial expressions were blurred with help of Photoshop. This was done to increase difficulty of deducing emotions from the facial expressions while adding a constraint, just like in Sivananthan et al. (2021). For the visual interference condition, grids were used from Croijmans, Arshamian, Speed and Majid (2021).

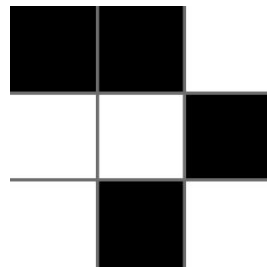


Figure 1. Example of a grid shown in the visual interference condition (Croijmans, et al., 2021).

Eventually, the set of stimuli consisted of 16 target stimuli (surprised or neutral face x 4 colours x 2 models) and 16 fillers (happy or angry face x 4 colours x 2 models). The total amount of experimental stimuli was 32 stimuli.

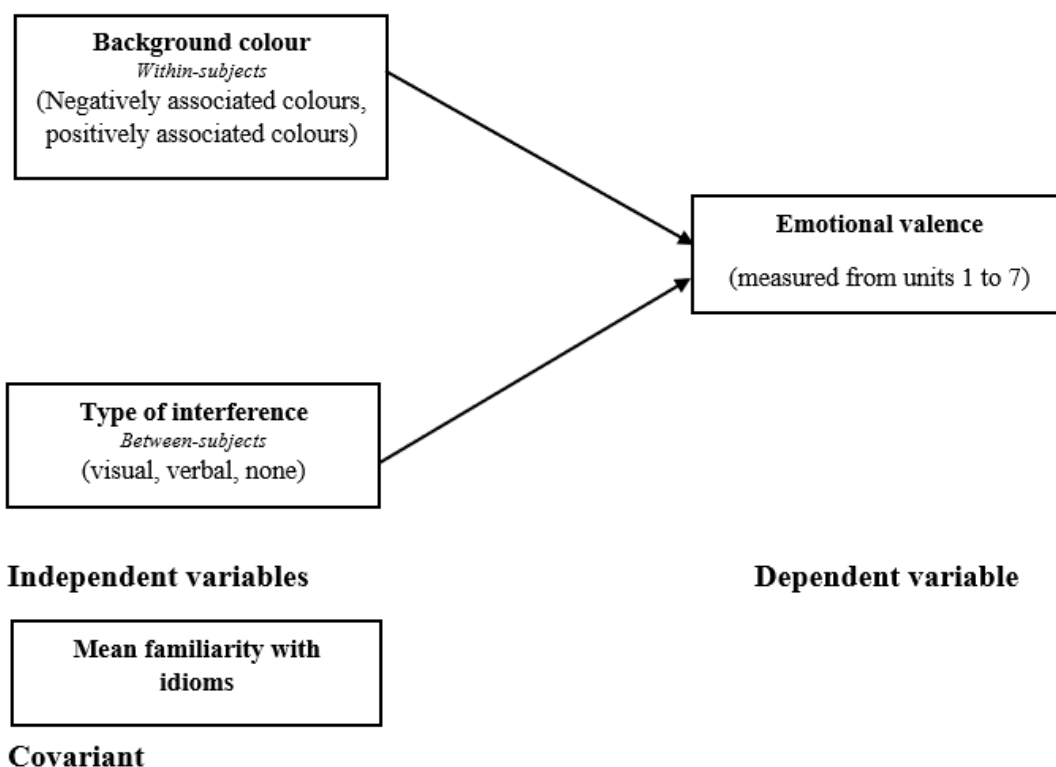
Table 2. The emotional valence of the colours used in the experiments according to the results of the analysis of Dutch colour idioms.

Emotional valence	Colour	Example	Meaning
Positive	Green	<i>Iemand het groene licht geven.</i> (Giving someone a green light.)	Giving someone permission.
	Pink	<i>Een roze bril op hebben.</i> (Wearing rose-tinted glasses.)	Not seeing negative sides of someone they are in love with.
Negative	Blue	<i>Iemand bont en blauw slaan.</i> (Hitting someone black and blue.)	Punching someone so hard the person gets bruised.
	Red	<i>De rode halsband krijgen.</i> (Getting the red collar.)	Being beheaded.

2.3.3 Design

In the experiment, the dependent variable, 'Emotional valence', was measured in units 1 (labelled 'extremely negative') to 7 (labelled 'extremely positive'). The facial expressions were combined with four different background colours: green and pink as positively associated

colours and blue and red as negatively associated colours. ‘Background colour’ therefore is an independent variable with two levels. Because participants all see the complete set of stimuli, ‘Background colour’ is a within-subject factor. ‘Interference type’, however, separates the participants in three groups: visual interference, verbal interference or no interference, making this a between-subject factor. ‘Mean familiarity with idioms’ was used as a covariate, because it was not a main element that was added to the emotional valence rating task but could still be of influence. The idioms were familiar for most of the participants, with an average score of 3.68 on scale of 1 (‘totally not familiar’) to 5 (‘really familiar’). See model 1 for a schematical view of the design of this study.



Model 1. The design of the current study

2.3.4 Procedure

Participants could enter the experiment by clicking the link to the Qualtrics® questionnaire. Each participant did the experiment individually. The entire questionnaire and all its instructions were in Dutch, to rule out any effects of a second language and to activate the native language.

The experiment started with a page which contained informed consent and a brief cover story. In this summary, participants were told that the study was investigating the ability to ignore background colour. When participants agreed with the terms and conditions, they continued to

answer some demographic questions. Then they started a familiarity rating task for idioms. Participants saw Dutch idioms and were asked to rate these idioms based on a five-point Likert scale ranging from 1 ('totally not familiar') to 5 ('really familiar'). Then participants entered part two of the experiment, which started with a practice session of six items. From here, the sample was split in three interference conditions. One third of participants were required to do a visual task before seeing each stimulus, in which a grid was shown with a different pattern of filled squares (see Figure 1). The grids that were used, originate from Croijmans, Arshamian, Speed & Majid (2021). Participants were told to memorize this grid. In the verbal interference condition, participants saw a digit string which they needed to memorize until after seeing the (practice) stimulus. One third of the population did not experience interference of the task.

In the second part of the experiment, participants saw a Caucasian adult male and female expressing happiness, surprise, anger or neutrality in each a different coloured background (See Figure 2). Participants did a valence rating for each stimulus that was shown. After each (practice) stimulus, the participants that entered the visual interference condition must select the grid they saw before the stimulus was shown out of two options. Another third of participants were given a verbal task before each stimulus, where they needed to type in the digit string shown beforehand. The last third of participants did not get any task and solely judged the stimuli on their emotional valence.

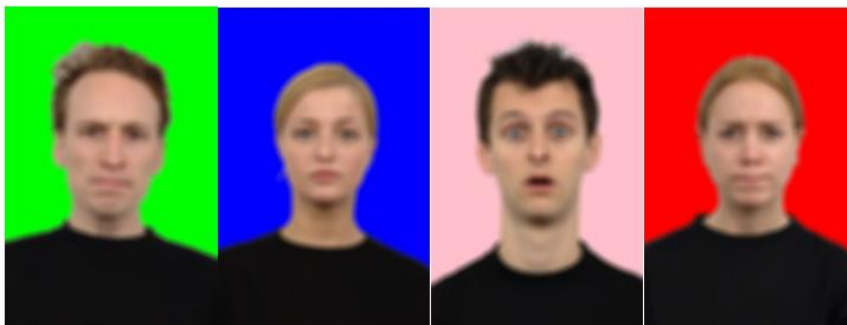


Figure 2. Examples of practice stimuli (left and middle-left) and experimental stimuli (middle-right and right).

After judging all of the experimental stimuli, participants are asked to guess the aim of the study. Lastly, followed a debriefing page, which thanked the participants for contributing to the study and reported the real aim of the study.

2.3.5 Statistical treatment

Chi square tests and one one-way ANOVA were done on each of the demographic questions to get insight into the population. With one between-subjects factor ‘Interference type’ and one within-subjects factor ‘Background colour’, a 3x2 mixed ANOVA was done in SPSS (IBM, Armon, NY, USA) after checking whether covariant ‘Mean score on idiom familiarity’ had more than 0.40 correlation with dependent variable ‘Emotional valence’ (Tvedt, 2000).

3. Results

3.1 Statistical analyses

The covariate ‘Mean score on idiom familiarity’ ($M = 3.68$, $sd = .45$), with a range between 2.61 and 4.61, was tested on their correlation with dependent variable ‘Emotional valence’. Table 3 visualises the correlation between the mean score of familiarity with the idioms and the score on emotional valence. The correlation between the covariate and dependent variable is less than 0.40. This means that one’s level of familiarity of idioms does not correlate enough with the scores on emotional valence to have an effect on the emotional valence rating behaviour of participants.

Table 3. Correlation between covariate ‘familiarity with idioms’ and ‘emotional valence’.

		Emotional Valence Mean
Mean idiom score	Pearson Correlation	.035
	Sig. (2-tailed)	.720
	N	109

Because the covariate and the dependent variable do not meet the requirement of having more than 0.40 correlation, a 2x3 mixed ANOVA was done between within-subjects variable ‘Background Colour’ (Positive vs. Negative colours) and ‘Interference type’ (No interference = 1, Visual interference = 2, Verbal interference = 3).¹

¹ Note: The version of the experiment on the laptop had a different lay-out from the mobile device: the stimulus was presented on the left side of the scale. This was corrected for by doing the mixed design ANOVA without the participants that used laptop (N = 5). There was no difference with the current outcomes.

Table 4. Mean score of emotional valence of negative colours and positive colours per condition and in total (M and SDs) on a scale of 1 to 7.

	Interference Type	Mean	Standard deviation
Negative colours	None	3.41	.44
	Visual	3.44	.34
	Verbal	3.40	.36
	Total	3.42	.38
Positive colours	None	3.60	.46
	Visual	3.66	.41
	Verbal	3.51	.37
	Total	3.59	.42

Results from a 2x3 mixed ANOVA showed a main effect of Colour ($F(1, 106) = 37.281, p = .001, \eta^2 = .263$). Stimuli with positive colours ($M = 3.59, s = .423$) were rated significantly higher on the scale of emotional valence compared to stimuli with negative colours ($M = 3.42, s = .465$). However, a significant main effect of ‘Type of interference’ on Emotional Valence was not found ($F(2, 106) = .538, p = .585, \eta^2 = .010$). This means that participants in the conditions ‘No interference’ ($M = 3.50, s = .427$), ‘Visual interference’ ($M = 3.55, s = .344$) and ‘Verbal interference’ ($M = 3.45, s = .348$) did not show enough difference in their rating of emotional valence to find a significant effect. Also, an interaction effect between ‘Background colour’ and ‘Interference type’ was absent ($F(2, 106) = 1.371, p = .258, \eta^2 = .025$). This indicated that the predicted interaction effect of background colour and interference was not there.

4.2 Summary of results

Study 2 provides evidence for an effect of colour in scores of perceived emotional valence between red and blue, which were found to be mainly negatively associated when used in Dutch idioms, and pink and green, which happen to be mostly positively associated in Dutch colour idioms. However, the current analyses failed to show an effect of idiom knowledge as a possible extra influence on perceived emotional valence of colours. Nor did it show a significant effect of verbal interference on the task. This outcome denied the direct effect of language on perceiving emotional valence.

4. Discussion

4.1 General Discussion

The current study aimed to investigate to what extent colour idioms influence the perception of emotional valence in ambiguous facial expressions, specifically Dutch colour idioms in native speakers of Dutch. Study 1 provided a qualitative approach to the etymology of colour associations in colour idioms of Dutch. Results showed that green, pink, white and gold were perceived more positively than negatively in colour idioms. Furthermore, blue, black, yellow and red were more associated with negativity than with positivity. These results reflect the findings of Alotaibi (2020), Kemertelidze and Giorgadze (2021) and part of the findings of Kaya and Epps (2004), however, yellow was found to be assessed as more positive in their study.

The background colours that are used in Study 2 were red and blue as negative colours and green and pink as positive colours. Results showed that the background colour had an influence on the perceived emotional valence of ambiguous faces. Stimuli with negative colours received a significantly lower score on the scale of emotional valence in comparison to stimuli with positive colours, which is in line with the hypotheses (hypothesis 1)

Red and blue are negatively associated colours, but not solely based on the results of Study 1. Blue has its negative connotations. According to study 1, blue in Dutch colour idioms mostly derives from paleness or oxygen-poor blood. This was in line with Alkawaz et al. (2015) found that this association is acquired from the flow of blood in a human's body. The skin gets a reddish colour when aroused, because the blood vessels widen and blood flow is more active. Contrarily, skin appears more bluish when feeling sad or cold, which are low arousal feelings. Blood does not flow actively, when the body is not aroused. That could be why blue is often associated with sadness, paleness and depression, hence its negative association.

Secondly, red is negatively associated. Earlier studies have shown the negative associations the colour red bears. Buechner, Maier, Lichtenfeld and Schwarz (2014) found that the colour red conveys feelings of 'threat' and 'anger', which are negative emotions. Not only does anger convey feelings of anger, Young, Elliot, Feltman and Ambady (2013) found that indicating facial configurations that resemble anger are facilitated when combined with a red background. The current results confirm that even without an angry facial expression, red backgrounds make faces appear more negative. A red-negativity effect, an effect that occurs when red strengthens the negative association, was concluded from results from Sivanathan, de Lissa and Curby

(2021): stimuli that were presented in a red background, were rated with greater negative response bias compared to green backgrounds. The current study confirms this, as stimuli with red backgrounds received lower scores on the scale of emotional valence and green backgrounds received higher scores on the scale of emotional valence.

The findings that positive coloured backgrounds (green and pink) seem to increase the perceived emotional valence, support results of Gil and Le Bigot (2014), who found that pink and green backgrounds enhanced positive facial expressions. They stated that green evokes feelings of calmness and happiness, promotes creativity and is associated with growth. Pink is strongly associated with femininity, which is related to sweetness, hope, optimism, happiness and affiliation (Gil & Le Bigot, 2014). When participants do a two-alternative forced choice task in which they have to indicate whether a face with a coloured background expressed a certain emotion or a sense of neutrality, stimuli with a pink or green background were more often selected as expressing a positive emotion and less often as a negative emotion. Sivananthan et al. (2021) add that green backgrounds also enhance perceived emotional positivity. Colour associations seem to go beyond a colour's presentation in isolation: also when green and pink are morphed with a face expressing emotion, these associations remain strong. The current study's results contribute to this claim and confirm that ambiguous faces are also perceived as more positive when accompanied with a green or pink background.

Roberson and Davidoff (2000) found that during memorization of target colours through a two-alternative forced choice task, between-category advantages disappear during verbal interference. That indicated that language has a facilitating effect on memorizing colours. This conclusion from earlier literature from Roberson and Davidoff (2000) led to the hypothesis that scores in the verbal interference condition would show more neutral ratings for ambiguous faces on the scale of valence in comparison with scores without interference and visual interference (hypothesis 2). This means that verbal interference would attenuate effects of coloured backgrounds during the emotional valence rating task (Study 2). However, the hypothesized possible direct effect of language, was not found.

The absence of an effect of verbal interference could be caused by the nature of the task. In Roberson and Davidoff (2000), accuracy was measured and between-category questions typically led to a better score in visual or no interference than within-category questions. The current experiment investigated ratings, based on opinions. This means that there was no such thing as accuracy or an effect of 'colour congruence advantage', because there was not a correct answer. Therefore it could be hard to measure a clear effect, since opinions may differ. Future

research could construct a type of accuracy by grouping the different parts of the scale together: left part of the scale ('extremely negative' to 'a little bit negative'), right part of the scale ('a little bit positive' to 'extremely positive') and the middle part of the scale ('neutral'). Accuracy can be measured in line of what is expected. An accurate answer on positively coloured backgrounds on ambiguous faces would then be a score on the right part of the scale.

Another reason could have been the low statistical power in this study. While 60 participants per condition equalled sufficient statistical power, this study only contained 31 to 39 participants per condition. Nevertheless, the trend in the results shows that the differences between ratings of positive and negative coloured backgrounds is smaller in the verbal interference condition. This is in line with hypothesis 2, which expected the ratings to be more neutral in comparison to ratings in other interference conditions. Further research could replicate Study 2, increase the power of the study and might find an effect.

Another explanation for the absence of the effect could be because the rating task was too cognitively exhausting for participants when doing the verbal interference task. People in this condition are asked to identify an emotion from a blurred face, 'ignore the background colours' (as stated in the cover story) and rate the stimulus meanwhile memorizing a digit string. This is in contrast with Roberson and Davidoff (2000), who just asked to memorize the presented target colour and point this colour out of two shades and reading aloud colour words. Focusing too much on the experimental task could have taken the attention away from memorizing the digit string, which could have decreased the saturation on the language faculty. Future research could decrease efforts of participants for doing a dual task that involves verbal interference (e.g. participants only have to memorize one single digit). Words with a certain valence or positive or negative connotations should not be used during verbal interference as the association with the word might also influence the rating of the stimulus as well.

Another important explanation for the absence of the direct effect of language could be because language is not used online during the task. In that case, language could not be the driver of the effect of colour. Positive and negative coloured backgrounds and their effect on perceived emotional valence seem to be driven from other ways of associations: like associations from experience and surroundings. This was shown by another study that did not find a direct effect of language. This study, which investigated the effect of language on sound associations, took Dutch and Farsi as contrastive languages. Dutch associates pitch in terms of high and low, whereas Farsi makes these associations in terms of thick and thin. Participants were trained in learning the pitch associations of the other language. They had to sing back tones after seeing

a thin or thick line (thickness interference) or high or low bar (height interference). A verbal interference task was added. Results showed that training Dutch speakers to talk like Farsi speakers, in terms of pitch associations, made them think more like the Farsi speakers about sound. However, verbal interference did not get rid of this training effect. During this study, it seems like thickness associations in interpreting pitch is only strengthening a pre-existing association between thick and low pitch and thin and high pitch. This is probably due to associations with thick-stringed instruments (e.g. cello), which makes low-pitched sounds and thin-stringed instruments (e.g. violin), that make high-pitched sounds. In the current study, the presence of the effect of colour and the absence of the direct effect of language could be explained likewise: associations between green, pink and negativity and blue, red and negativity might already pre-exist outside of language. Using congruent coloured backgrounds might have strengthened these pre-existing associations. Future research could investigate whether priming participants with positive and negative adjectives in congruent (positive adjectives in negative colours) and incongruent conditions (positive adjectives in negative colours) would show a direct effect of language during the experiment of Study 2.

A correlation between idiom familiarity scores and scores on perceived emotional valence was not found, which could once again be a result of limitations in this study. Explanations for the absence of idiom familiarity as a possible covariate could be because of a mistake during the data collection: one participant pointed out that a sentence in the explanation of the familiarity scale of idioms was not completed. Beforehand, each point on the five-point Likert scale was explained, but the last few words of the point 'really familiar' were omitted. However, most participants that pointed this out understood correctly which words were absent. When someone noticed the mistake, 63 participants had filled in the list. This was corrected right away.

Similarly to the current study, Sivananthan et al. (2021) found that emotionally ambiguous faces that are presented in front of a green background and judged in combination with a time constraint were rated less negative in comparison to the same faces in combination with a red or grey background. Furthermore, ambiguous faces presented in front of a red background were rated more negative in comparison to green and grey backgrounds. Their results also showed that a combination of happy and green and angry and red strengthen this green-positivity and red-negativity effect. This study adds that ambiguous faces, in combination with pink and green are rated more positively in comparison to red and blue, even without a time constraint.

4.2 Conclusion

Firstly, the current study increased knowledge of Dutch colour idioms. Secondly, this study contributes to the claim that red has a strong relation to negativity and green a strong relation to positivity. Furthermore, it adds more evidence to the negative association of red and blue and the positive association of green and pink. Results showed that language was not used online while rating emotionally ambiguous facial expressions, so Dutch colour idioms and their valence do not seem to have an influence on perceiving emotionally ambiguous facial expressions. Nevertheless, colour was found to influence perceived emotional valence. This is in accordance with earlier research that found that green makes ambiguous faces seem more positive and red makes these faces seem more negative (Gil & Le Bigot, 2014; Sivananthan et al. 2021). Furthermore, these results add to the results of Gil & Le Bigot (2014), who found that pink had the same positive effect on perceiving faces as green. Lastly, the current research has provided evidence that blue has a negative effect on ratings of perceived emotional valence.

References

- Alotaibi, W. (2020). Colour idioms in English and Arabic: Their meaning and colour associations. *European Journal of English Language Teaching*, 0. doi:10.46827/ejel.v0i0.2968
- Alkawaz, M. H., Mohamad, D., Saba, T., Basori, A. H. & Rehman, A. (2015). The correlation between blood oxygenation effects and human emotion towards facial skin colour of virtual human. *3D Research*, 6. doi: 10.1007/s13319-015-0044-9.
- Bazley, W. J., Cronqvist, H., & Mormann, M. (2017). In the red: The effects of color on investment behavior. *Swedish House of Finance research paper*, 17, 16. doi: 10.2139/ssrn.2992812
- Beelen, H. & Van der Sijs, N. (2016). Woordsprong. *Bril*. Consulted at <https://www.etymologiebank.nl/trefwoord/bril>
- Bidelman, G. M., Hutka, S., & Moreno, S. (2013). Tone language speakers and musicians share enhanced perceptual and cognitive abilities for musical pitch: evidence for bidirectionality between the domains of language and music. *PloS one*, 8(4), e60676. doi:10.1371/journal.pone.0060676

- Cox, H. L., Cox-Leick, A. M. A., Hannay, M., Hiemstra, Y. F. (1992). *Spreekwoordenboek in zes talen: Nederlands, Frans, Duits, Engels, Saans, Latijn*. Utrecht/Antwerpen: Van Dale Lexicografie.
- Cox, H. L., Cox-Leick, A. M. A., Hannay, M., Glorie, I., Van der Kooi, J. & Stoks, F. C. M. (2000). *Spreekwoordenboek: Nederlands, Fries, Afrikaans, Engels, Duits, Frans, Spaans, Latijn*. Utrecht/Antwerpen: Van Dale Lexicografie.
- Croijmans, I., Arshamian, A., Speed, L. J., & Majid, A. (2021). Wine experts' recognition of wine odors is not verbally mediated. *Journal of Experimental Psychology: General*, *150*(3), 545–559. [doi:10.1037/xge0000949](https://doi.org/10.1037/xge0000949)
- De Coster, M. (2022). Roze wolk. Ensie: Betekenis & Definitie. Consulted at [https://www.ensie.nl/woordenboek-van-populair-taalgebruik/roze-wolk#:~:text=\(1909\)%20\(clich%C3%A9\)%20gevoel,kan%20ook%20op%20druggebruik%20slaan](https://www.ensie.nl/woordenboek-van-populair-taalgebruik/roze-wolk#:~:text=(1909)%20(clich%C3%A9)%20gevoel,kan%20ook%20op%20druggebruik%20slaan)
- Elliot, A. J., & Maier, M. A. (2012). Chapter two: Color-in-context theory. In P. Devine, & A. Plant (Eds.), *Advances in experimental social psychology*, Vol. 45, pp. 61–125). Academic Press. doi: 10.1016/B978-0-12-394286-9.00002-0.
- Gil, S. & Le Bigot, L. (2014). Seeing Life through Positive-Tinted Glasses: Color–Meaning Associations. *PLOS ONE* 9(8). [doi: 10.1371/journal.pone.0104291](https://doi.org/10.1371/journal.pone.0104291)
- Gil, S., & Le Bigot, L. (2015). Grounding context in face processing: Color, emotion, and gender. *Frontiers in Psychology*, *6*(322). [doi: 10.3389/fpsyg.2015.00322](https://doi.org/10.3389/fpsyg.2015.00322)
- Hubers, F., Van Ginkel, W., Cucchiari, C., Strik, H. & Dijkstra, A.F.J. (2018). *Normative data on Dutch idiomatic expressions: Native Speakers* [dataset].
- IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.
- Kaya, N., & Epps, H. H. (2004). Relationship between color and emotion: A study of college students. *College student journal*, *38*(3), 396-405.

- Kemertelidze, N. & Giorgadze, M. (2021). Impact of Colour Symbolism on English Colour Idioms and their Georgian Equivalents. *International Journal of Innovative Technologies in Social Science*, 1 (29). doi: 10.31435/rsglobal_ijitss/30032021/7543.
- Koops, E. (2020, 20 January). Geen rooie cent hebben: Herkomst van de uitdrukking. Consulted at <https://historiek.net/geen-rooie-cent-hebben-herkomst-uitdrukking/70472/#:~:text=De%20zegswijze%20'geen%20rooie%20cent,geslagen%20uit%20koper%2C%20specifiek%20roodkoper.>
- Kuhbandner, C., & Pekrun, R. (2013). Joint effects of emotion and color on memory. *Emotion*, 13(3), 375–379. Doi:10.1037/a0031821
- Langner, O., Dotsch, R., Bijlstra, G., Wigboldus, D., Hawk, S. & Van Knippenberg, A. (2010). *Radboud Faces Database*. [dataset].
- Lenneberg, E.H. (1967). *Biological Foundations of Language*. Wiley Online Library.
- Majid, A. (2018). Language and cognition. In *The International Encyclopedia of Anthropology*. John Wiley & Sons Ltd.
- Maksimovna, K. V. (2016). Colour idioms in the English, German and Russian languages. *European journal of literature and linguistics*, 3.
- Malá, J. (2003, September). “Frazeologizmy v masmédiích”. Consulted from Václavíková (2010).
- Onze Taal. (2011, 30 August). Blauwe Maandag: Waar komt het gezegde een blauwe maandag vandaan? Consulted at <https://onzetaal.nl/taaladvies/blauwe-maandag>
- Paoletti, J. B. (1997). The gendering of infants’ and toddlers’ clothing in America, *The material culture of gender, the gender of material culture*. University Press of New England, Hanover, NH.
- Rakhieh, B., Al-Saidat, E., Alshammari, J. & Rabab'ah, K. (2014). Translation of Cultural Bound Color-Based Idioms: A Case Study of Jordanian BA English Students. *International Journal of Translation*, 26.
- Regier, T., & Xu, Y. (2017). The Sapir-Whorf hypothesis and inference under uncertainty. *Wiley Interdisciplinary Reviews: Cognitive Science*, 8(6), e1440.

- Roberson, D., Davies, I. & Davidoff, J. (2000). Color categories are not universal: Replications and new evidence from a stone-age culture. *American Psychological Association, General*, 12, 369–398. doi:10.1037/0096-3445.129.3.369
- Roberson, D., & Davidoff, J. (2000). The categorical perception of colors and facial expressions: The effect of verbal interference. *Memory & Cognition*, 28, 977-986.
- Tvedt, J. M. (2000). Some factors that effect [sic] statistical power in ANCOVA: a population study. *Theses Digitization Project*. John F. Pau Library, California State University, San Bernadino.
- Saysani, A., Corballis, M. C., & Corballis, P. M. (2021). Seeing colour through language: Colour knowledge in the blind and sighted. *Visual Cognition*, 1–9. doi: 10.1080/13506285.2020.1866726
- Sivananthan, T., de Lissa, P., & Curby, K.M. (2021). Colour context effects on speeded valence categorization of facial expressions. *Visual Cognition*, 29, 348 - 365. doi: 10.1080/13506285.2021.1915901
- Spreekwoorden en Gezegden (2022). Consulted at <https://spreekwoorden-gezegden.nl/>.
- Václavíková, E. (2010). Idioms of Colour. A Corpus-based Study. *Retrieved from Academia database*.
- Van der Meulen, R. (1926). Bont en blauw. *Tijdschrift voor de Nederlandse Taal- en Letterkunde, jaargang 45*, 60. Consulted at: https://www.dbnl.org/tekst/tij003192601_01/tij003192601_01_0009.php
- Van Wyk, G. J. (2003). Etimologiewoordeboek van Afrikaans. Consulted at <https://etymologiebank.nl/trefwoord/schaamrood>.
- Wikipedia (2022). Uitdrukkingen en gezegden met kleuren. Consulted at https://nl.wikipedia.org/wiki/Lijst_van_uitdrukkingen_en_gezegden_met_kleuren.
- Winawer, J., Witthoft, N., Frank, M., Wulund, L., Wade, A. & Boroditsky, L. (2007). The Russian Blues Reveal Effects of Language on Color Discrimination. *Proceedings of the National Academy of Sciences of the United States of America*, 104, 7780-7785. doi:10.1073/pnas.0701644104.
- Woorden.org (2022). Consulted at <https://www.woorden.org/spreekwoord.php>.

Young, S. G., Elliot, A. J., Feltman, R., & Ambady, N. (2013). Red enhances the processing of facial expressions of anger. *Emotion, 13*(3), 380–384. Doi: 10.1037/a0032471

Appendix A: List of idioms (Study 1)

Colour	Association	Valence (colour of idiom)	Idiom	Translation	Meaning
<u>Red</u>	Colour	Neutral	Zo rood als een kreeft.	As red as a lobster.	To turn red
	Colour	Negative	Zo rood worden als een kalkoense haan.	As red as a Turkey.	To turn red from anger.
	Copper	Negative	Geen rooie cent hebben.	To have no red cent.	To be broke.
	Colour	Negative	In de rode cijfers komen.	To come into the red numbers.	To have debts.
	Significancy	Neutral	De rode draad	The red thread.	A motive that frequently reoccurs in a story.
	Colour	Negative	Het schaamrood op de kaken.	The shame on the jaws.	To shame deeply.
	Fire	Negative	De rode haan laten kraaien.	To let the red rooster crow.	To set something on fire.
	Significancy	Positive	De rode loper voor iemand uitleggen.	To lay out the red carpet for somebody.	To receive someone with a lot of respect.
	Colour	Neutral	Hij wordt rood tot in het haar.	He turns red beyond his hair.	He blushes.
	Blood	Negative	De rode halsband krijgen.	To get the red collar.	To be beheaded.
	Significancy	Positive	Met rode letters in de almanak.	With red letters in the almanac.	Something that is marked because it is important.
	Copper	Neutral	Voor zijn roodkoperen.	With his copper.	That is sorted out well.
	Colour	Negative	Als een stier op een rode lap reageren.	To react as a bull to a red cloth.	To react exaggerated (anger).
	Justice	Negative	Hij moet voor de rode deur komen.	He has to come for the red door.	He has to go to court.
	Hair colour	Neutral	Rood haar en elzenhout zijn op geen goede grond gebouwd.	Red hair and alder wood are not built on good ground.	Redheads cannot be trusted.
	Sun	Positive	Heden rood, morgen dood.	Red in the present, dead tomorrow.	Life is short and fragile.

	Maximum pressure on kettle	Neutral	Over de rooie gaan	To go over the red.	Being out of your mind from anger.
	Colour	Positive	Zout en brood maken de wangen rood.	Salt and bread make the cheeks red.	Living a simple life is healthy.
Yellow	Money (25 goulder bill)	Neutral	Een geeltje van de plank nemen.	To take a small yellow one from the shelf.	Repeating an old preach.
	Football	Negative	Een gele kaart krijgen.	To receive a yellow card.	To get a warning.
	Emotion	Negative	Geel van nijd zien.	To see yellow from envy.	To look very angry.
	Emotion	Negative	Geel van afgunst.	Yellow with disgust.	To be jealous.
Green	Nature	Positive	Groene vingers hebben.	To have green fingers.	To be committed to plants.
	Nature	Neutral	Zo groen als gras zijn / Groentje zijn.	To be as green as grass.	To be unexperienced.
	Green from the First Chamber	Neutral	Aan de groene tafel zitten.	To sit at the green table.	To be a board member.
	Nature	Positive	Bij de burens is het gas altijd groener.	The grass is greener at the neighbours.	Everything looks better in other people's lives.
	Nature	Neutral	Onder de groene zoden liggen.	To lay beneath the green sods.	To be buried.
	Nature	Positive	Zijn koren groen eten.	To eat his corn green.	Not worrying about the future.
	Green traffic light	Positive	Iemand het groene licht geven.	To give somebody the green light.	To give someone permission.
	Positivity	Positive	Hij is er niet groen op.	He is not green on it.	He does not like doing this.
	Significance	Positive	Hij zat aan haar groene zijde	He sat on her green side.	They were sitting next to each other.
	Unknown	Negative	Iemand groen op het lijf vallen.	To fall green on someone	To look for trouble.

	Unripe fruits	Neutral	Rijp en groen lezen.	To read ripe and green.	To read everything mixed together.
	Youth	Positive	Een oude bok lust nog wel een groen blaadje.	An old goat still likes a green leaf.	Older men think younger women are attractive.
	(Un)ripe fruits	Neutral	Groene kersen worden rood.	Green cherries turn red.	Small children mature very fast.
	Association with anger, jealousy and disgust from the past	Negative	Groen zien.	To see green.	To be jealous.
	Association with anger, jealousy and disgust from the past	Negative	Groen lachen.	To laugh greenly.	To laugh away anger, disappointment or embarrassment.
	Youth	Neutral	Bij een groen gezelschap dient een witte baard.	With a green company, a white beard is needed.	Younger people are dependent on the elderly.
Blue	Evil	Negative	Bekend staan als de bonte hond met de blauwe staart.	To be known as the pied dog with the blue tail.	To be notorious.
	Colour	Neutral	Een blauwe boon.	A blue bean	A bullet.
	Short, not a lot of value	Negative	Een blauwe maandag.	A blue Monday.	Very short.
	Paleness	Negative	Een blauwe scheen lopen.	To walk a blue shin.	To be rejected.
	Paleness	Negative	Een blauwtje lopen.	To walk a little blue one.	To be rejected in love.
	Blood/bruises	Negative	Iemand bont en blauw slaan.	To hit someone black and blue.	To punch someone so hard the person gets bruised.
	Void	Negative	Iets blauw blauw laten.	To leave something blue blue.	To leave something as it is, not talking about it.
	Unknown	Negative	Zij hangt haar man de blauwe huik om.	She hangs her husband's blue hood around his neck.	She is cheating on her husband.

	English ribbon associated with alcohol abuse	Positive	Van de blauwe knoop zijn.	To be from the blue knot.	Not drinking alcohol.
	Not mixed (back from the Spanish occupation of the Netherlands)	Positive	Blauw bloed hebben.	To have blue blood.	To be family to one of nobility or to a royal.
	Paleness	Negative	Staan te blauwbekken.	Standing in awe.	To wait in the cold.
	Paleness	Negative	Hij is blauw.	He is blue.	He drank too much alcohol.
	Blue bills of ten goulder	Neutral	Hij zal er zijn vingers niet blauw aan tellen.	He will not count his fingers blue from it.	Not counting much money.
	Blue bills of ten goulder	Neutral	Je blauw betalen aan iets.	To pay blue from something.	To pay too much money.
	Colour	Neutral	Blauwe druiven, blauwe jongens.	Blue grapes, blue boys.	Children are much alike to their parents.
	Blue stockings	Neutral	Een blauwkous zijn	To be a blue stocking.	To be an educated woman who does not like to do much of the house chores.
	Sky	Positive	Is de hemel heden grauw, morgen is hij blauw.	If the sky is grey today, it is blue tomorrow.	Do not get too sad when life seems against you.
	Colour	Positive	Iemand op zijn blauwe ogen geloven.	To believe someone on their blue eyes.	To believe someone is speaking the truth.
Sleep	Neutral	Als de hemel naar beneden komt, hebben we allemaal een blauwe hoed.	When the sky falls, we will all wear a blue hat.	(You say this when someone is making excuses).	
White	Purity	Positive	Bij iemand een wit voetje halen.	To get a white foot at someone.	To try to favour someone.
	Beauty	Positive	De prins op het witte paard.	The prince on the white horse.	The man of your dreams.

Extraordinary	Positive	Een witte raaf.	A white rave.	Something that seldom happens.
Peace	Positive	Het is wit.	It is white.	Two people agree.
Clear	Neutral	Zwart op wit hebben.	To have something black on white.	To have evidence.
Beauty	Positive	Witte paarden hebben veel stro nodig.	White horses need a lot of straw.	Showy women ask a lot of you financially.
Marriage	Positive	De wittebroodsweken.	The honeymoon.	The first weeks of marriage.
Evil eyes	Negative	Hij heeft te veel in de ogen.	He has too much white in his eyes.	He is a bad person.
Paleness	Negative	Wit om de neus worden.	To become white around the nose.	To get afraid.
Clean	Positive	Geld witwassen.	To whitewash money.	Making services that are not paid for in taxes.
Paleness	Negative	Zie ik zo wit?	Do I look that white?	Do you think I am crazy?
Richness	Positive	Wie geen wit brood heeft, doet het met bruin.	Who does not have white bread, has to eat brown (bread).	When you cannot get the best, you have to deal with less.
Flour	Negative	Wie niet wit wilt worden, moet uit de molen blijven.	Who does not want to get white, has to stay out of the mill.	When you mind a certain business, you cannot complain about the disadvantages that come with it.
Flour	Neutral	De witte rok maakt de molenaar niet.	The white skirt does not make the miller.	You cannot base everything on someone's appearance.
Smoke	Neutral	Er is witte rook.	There is white smoke.	The results are announced.

	Elderly	Positive	Bij een groen gezelschap dient een witte baard.	With a green company, a white beard is needed.	Younger people are dependent on the elderly.
Black	Evil	Negative	Iemand zwart maken.	To make someone black.	Speaking about someone in a negative way.
	Evil	Negative	Daar komt de zwarte kat in.	There comes the black cat.	There will be a quarrel.
	Evil	Negative	De pot verwijt de ketel dat die zwart ziet.	The pot is calling out the kettle for seeing black.	To point to someone else to blame.
	Evil	Negative	De zwarte kat krabt niet.	The black cat does not scratch.	Do not let your fears control you.
	Evil	Negative	Het zwarte schaap van de familie.	The black sheep of the family.	Someone who is treated a little bit differently from the rest.
	Evil	Negative	Iemand met zwarte kool tekenen.	To draw somebody in black coal.	To introduce someone in a negative way.
	Nature	Negative	Op zwart zaad zitten.	To sit on black seeds.	To have no money.
	Evil	Negative	Zorg dat daar geen zwarte hond tussen komt.	Make sure that a black does not interfere.	Make sure that nothing goes wrong.
	Evil	Negative	Zwart zien van de honger.	To see black from hunger.	Being very hungry.
	Evil	Negative	Hij liegt dat hij zwart ziet.	He lies that he sees black.	He is a big liar.
	High density	Neutral	Het ziet zwart van de mensen.	It looks black with people.	It is very crowded.
	Darkness	Negative	Zwarte sneeuw zien.	To see black snow.	To have depressing prospects.
	Evil	Negative	Een zwarte bladzijde in de geschiedenis.	A black page in history.	A horrible period in the past.
	Evil	Negative	Hij is nog zwarter dan de duivel.	He is blacker than the devil.	He is a bad person.
Evil	Negative	Een zwartrijder	A black-rider.	Traveling with public	

					transport without paying.
	Evil	Negative	Een zwartwerker.	A black-worker.	Someone who works without paying taxes.
	Evil	Negative	De duivel is niet zo zwart als men hem schildert.	The devil is not as black as one paints him.	Someone who gets talked about a lot in a negative way, still has some good traits.
	Darkness	Negative	Menig bruiloftskleed is met de zwarte baai gevoerd.	Many wedding dresses have been fed by the black bay.	In many marriages, one experiences bad luck and sadness.
	Evil	Negative	Wie anderen zwart maakt, blijft zelf niet wit.	Who makes other people black, does not stay white.	One who talks badly about others, is not making a good reputation him/herself.
	Darkness	Negative	Succes met een zwart randje.	Success with a black lining.	Success but with a negative footnote.
	Darkness	Negative	Een zwartkijker.	A black-viewer.	A pessimist.
	Evil	Negative	Wie niet zwart is, hoeft zich ook niet te wassen.	Who is not black, does not need to wash him/herself.	One who is not guilty, does not need to justify him/herself.
Gold	Great value	Positive	Je gewicht in goud waard zijn.	Weigh your weight in gold.	Contribute a lot in a positive way.
	Beauty	Positive	Al draagt een aap gouden ring, het is en blijft een lelijk ding.	Even if a monkey wears a golden ring, it is and stays an ugly thing.	Someone that looks beautiful is not from itself beautiful.
	Beauty	Positive	Als een pareltje in het goud zitten.	To sit as a pearl in the gold.	To be nice with people in their surroundings.
	Great value	Positive	De dans om het gouden kalf.	The dance for the golden calf.	The competition to be rich.

	Great value	Positive	De morgenstond heeft goud in de mond.	The morning has gold in its mouth.	Starting the day early makes you able to be more productive.
	Great value	Positive	Een goede daad is goud waard.	A good deed is worth gold.	Helping others is good.
	Great value	Positive	Een goed hart is goud waard.	A good heart is worth gold.	You do not often find people that genuinely want the best for you.
	Great value	Neutral	Een gouden dak op het huis hebben.	To have a golden roof on the house.	Living in a house that is built on lended money.
	Beauty	Positive	Een gouden hart hebben.	To have a golden heart.	To be very sweet.
	Beauty	Positive	Een gouden zadel maakt geen ezel tot paard.	A golden seat does not make a donkey turn into a horse.	Someone cannot change solely through appearance.
	Great value	Positive	Eigen haard is goud waard	Your own fire place is worth gold. (Your home is a castle)	Being home is worth a lot.
	Great value	Positive	Goede raad is goud waard.	Good advice is worth gold.	With advice you can achieve a lot.
	Beauty	Positive	Gouden appels op zilveren schalen.	Golden apples on silver plates	To formulate something in a beautiful way.
	Great value	Positive	Gouden bergen beloven.	To promise golden mountains.	To promise something impossible.
	Beauty	Neutral	Het is niet al het goud dat blinkt.	It is not always gold that shines.	Everything is not what it seems.
	Great value	Positive	Iemand koeien met gouden horens beloven.	To promise someone cows with golden horns.	To promise something but not fulfil the promise.
	Great value	Negative	Voor geen goud willen doen.	Not wanting to do	Not wanting to do something.

			something for gold.	
Beauty	Positive	Met een gouden hengel vissen	To fish with a golden rod.	Achieving one's goal with cheating.
Great value	Positive	Op een goudschaaltje leggen.	To weigh on a golden scale.	Weighing things very carefully.
Unknown	Neutral	Pimpelpaars met een goud randje.	Purple with a golden edge.	With an undefined colour.
Great value	Positive	Goudeerlijk zijn.	To be golden-honest.	To be really honest.
Great value	Positive	Dat zijn appels op gouden benen.	Those are apples on golden legs.	That is really extraordinary.
Beauty	Positive	Iemand in goud beslaan.	To cover someone in gold.	To appreciate someone a lot.
Beauty	Positive	Geen goud zonder schuim.	No gold without foam.	Even the best things/people have issues.
Great value	Positive	Een goede naam is goud waard.	A good name is worth gold.	A good name is the most valuable thing someone can have.
Great value	Positive	Men moet de kip met de gouden eieren niet slachten.	One should not slaughter the chicken with the golden eggs.	If someone wants to get the most out of an advantage, one ultimately gets harmed him/herself.
Great value	Positive	Zelden mist, wie met een gouden angel vist.	One who fishes with a golden stings rarely misses.	You get a lot done with a lot of money.
Great value	Positive	Spreken is zilver, zwijgen is goud.	Speaking is worth silver, keeping silent is worth gold.	Sometimes it is better not to speak.
Great value	Positive	Een vluchtende vijand moet men een gouden brug bouwen.	One should build a golden bridge for a	You have to give a defeated opponent the chance to escape.

				fleeing enemy.	
	Great value	Positive	Kleine dieven hebben grote gouden ketens.	Small thieves have big golden chains.	With money, you can make your stay in prison more pleasant.
	Great value	Positive	Een handwerk heeft een gouden bodem.	Handwork has a golden bottom.	When you have a good profession, you earn a lot of money.
Pink	Love	Positive	Een roze bril op hebben.	Wearing rose-tinted glasses.	Not seeing the negative sides of someone they are in love with.
	Love	Positive	Op een roze wolk zitten.	Sitting on a pink cloud.	To be very in love or optimistic.

Appendix B: List of idioms used in the familiarity task (Study 2)

Number	Idiom	Colour idiom
1	Je blauw betalen aan iets.	✓
2	Zijn koren groen eten.	✓
3	Zijn nek uitsteken.	✗
4	Eieren kiezen voor zijn geld.	✗
5	De rode halsband krijgen.	✓
6	Een blauwtje lopen.	✓
7	Ergens tabak van hebben.	✗
8	Hij is er niet groen op.	✓
9	Op een roze wolk zitten.	✓
10	Als een stier op een rode lap reageren.	✓
11	Als paddenstoelen uit de grond schieten.	✗
12	Iemand groen licht geven.	✓
13	De hand op de knip houden.	✗
14	Staan te blauwbekken.	✓
15	Over de rooie gaan.	✓
16	Een punthoofd krijgen van iets.	✗
17	Groene vingers hebben.	✓
18	Een blauwe maandag.	✓
19	Elkaar in de haren vliegen.	✗
20	Geen rooie cent hebben.	✓
21	Uit zijn vel springen.	✗
22	Iemand bont en blauw slaan.	✓
23	Van de regen in de drup raken.	✗
24	Het gras bij de burens is altijd groener.	✓
25	De kat op het spek binden.	✗
26	Zo rood als een kalkoense haan.	✓
27	Het spits afbijten.	✗
28	Een roze bril ophebben.	✓

