This is the peer reviewed version of the following article:

Mohr, C., Jonauskaite, D., Dan-Glauser, E. S., Uusküla, M., & Dael, N. (2018).

Chapter 11. Unifying research on colour and emotion: Time for a cross-cultural survey on emotion associations with colour terms. In L. W. MacDonald, C. P. Biggam, & G. V Paramei (Eds.), *Progress in Colour Studies: Cognition, language, and beyond* (pp. 209–222). Amsterdam: John Benjamin's Publishing Company. http://doi.org/10.1075/z.217.11moh.

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Unifying research on colour and emotion: Time for a cross-cultural survey on emotion associations with colour terms

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Abstract

Popular opinions link colours and emotions. Yet, affective connotations to colours are heterogeneous (e.g. red represents anger and love) partly because they relate to different contexts. Despite insufficient evidence, colours are used in applied settings (health, marketing, etc.) for their supposed effects on cognitive and affective functioning. Summarizing the literature, we invite for systematic research to investigate when and how colours link with affective phenomena. We need to i) distinguish between situations in which colours are physically shown or linguistically treated, ii) specify types of affective processes (e.g. emotion, mood, preference), and iii) investigate cross-cultural differences. Having these needs in mind, we initiated an international online survey on semantic colour-emotion associations. We outline theoretical considerations and present the survey's design.

1. Understanding colour choices in applied contexts: Linking to cognitive-affective functioning

We commonly experience a large diversity of colours. In nature, we are exposed to coloured plants, animals, and landscapes. Our ancestors developed skills and knowledge that allow the colouring of the environment. The first colour decorations of caves date back at least 40,200 years (Pike, Hoffmann, Garcia-Diez, Pettitt, Alcolea, De Balbin, Gonzalez-Sainz et al. 2012). Nowadays, we continue to paint and shape public as well as private spaces to our liking (e.g. interior walls, furniture) or according to what is considered appropriate (e.g. hospitals frequently in white) and understood (traffic light colours; Tak and Toet 2014). In addition, we can choose amongst many colours when adding these to ourselves (e.g. makeup, clothes) or objects (e.g. cars, accessories) following fashion trends to some extent. Yet, we are unlikely to choose random colours, but consider more or less deliberately what the preferred colour would be, given particular settings or moments in time (e.g. Jonauskaite, Mohr, Antonietti, Chèvre, and Dael 2016; Schloss, Nelson, Parker, Heck, and Palmer 2016).

With the possibility to produce and flexibly use a large variety of colours on or around objects (e.g. paint, textile, but also digital), industry and the general public show a continued if not increasing interest in colour psychology. Popular media books in different languages (Causse 2014; Walker 2015; Weaver 2015) advise individuals to select the *right* colour to boost cognitive functioning, control desires, or enhance professional success or well-being. Paint companies advise clients which colour to use for particular situations in the private (Dulux 2016) and public (Radwan 2015)

environment. In the marketing domain, professionals in brand managing base their decisions on trial and error or recommendations by colour consultants (Gorn, Chattopadhyay, Yi, and Dahl 1997). Thus, the public shows a desire for advice on colour choice.

Evidence-based studies are unfortunately insufficiently exhaustive and systematic to know which colour is best for which object or context. Some studies, for example, investigated colours for particular interior spaces (Genschow, Noll, Wanke, and Gersbach 2015; Lee, Guillet, and Law 2016; Manav 2007; Schauss 1979, Umamaheshwari, Asokan, and Kumaran 2013; Yildirim, Hidayetoglu, and Capanoglu 2011) while others investigated appropriate colours for logos (Bottomley and Doyle 2006; Labrecque and Milne 2012) or websites (Bakhshi and Gilbert 2015). Assumptions that guide these studies and explain their results focus on psychological research, namely the impact of colour on cognitive and affective functioning and behaviour. While these studies are certainly interesting, they link (if at all) results from scientific, often laboratory studies on colour and affect to real world questions (contextualizing the research). By doing so, results from relatively scarce scientific studies using all kind of domains and paradigms are compared, and so are different concepts. As we will see, conclusions are overly extrapolated.

In one example, customers evaluated the interior space of a restaurant more positively when the walls were painted violet as opposed to yellow (Yildirim et al. 2007). The authors discussed that "This result supports the definition of Valdez and Mehrabian (1994: 3238) that short wavelength colors—associated with 'cool' colors—like violet or blue are preferred, leading to a linear association between affective tone and wavelength". However, the study by Valdez and Mehrabian (1994) did not test preference ratings but affective ratings of colour chips. Also, the

brightness level was the strongest predictor of pleasantness ratings in Valdez and Mehrabian (1994), yet Yildirim and colleagues (2007) did not specify brightness levels in their set-up. Likewise, Bottomley and Doyle (2006: 67–68) argue that "red will be more appropriate than blue for sensory-social products", supposedly because literature has shown that red has connotative meanings related to active, strong, love etc. This reasoning connects abstract connotations of red to concrete social needs (personal expression, sensory pleasure, etc.) and products (night club, perfume, etc.). This connection, however, needs to be empirically shown for the extrapolation to hold. Taken the above, we need systematic fundamental colour research before being able to apply the findings to contextualized real life situations and reliably inform colour consumers.

2. Unifying research on colour and emotion psychology

As we will outline below, results from different studies seem too heterogeneous and context-dependent to allow such general statements on theoretical and applied links between colour and human cognitive and affective functioning. For this reason, we would like to highlight some factors, though not an exhaustive list, that should be more thoroughly considered when performing studies on colour psychology and affect. We highlight the necessity to dissociate between i) exposure to physical versus linguistic colour representations (e.g. colour terms), ii) operationalization (i.e., defining abstract concepts into measurable variables) in the affective sciences, and iii) cross-cultural and cross-linguistic differences.

2.1 *Exposure to physical versus linguistic colour representations*

With regard to exposure to physical versus linguistic colours, many results are based on paradigms in which researchers either physically show colours (e.g. Hemphill 1996; Murray and Deabler, 1957; Valdez and Mehrabian 1994) or tap on the linguistic representation of colours. A linguistic representation may be generated, for example, by presenting colour terms (e.g. Soriano and Valenzuela 2009; Sutton and Altarriba 2016). A physical representation could be measured by asking participants to produce a colour that fits particular emotions (Dael, Perseguers, Marchand, Antonietti, and Mohr 2016) or complete affective drawings by colouring them (Burkitt, Barrett, and Davis 2003; Burkitt, Tala, and Low 2007). In addition, tasks on colour-affect relationships can be very different. Participants may have to select a physical colour to a given affective term (e.g. D'Andrade and Egan 1974; Wexner 1954) or select/rate affective terms to a given physical colour (e.g. Madden, Hewett, and Roth 2000; Ou, Luo, Woodcock, and Wright 2004) or colour term (Adams and Osgood 1973; Hupka, Zaleski, Otto, Reidl, and Tarabrina 1997; Johnson, Johnson, and Baksh 1986). We are not aware that researchers would consider such methodological differences important when reasoning on their studies on colour-affect relationships.

So far, accounts of specific affective correlates of a particular colour are inconclusive. Take findings on red, so far most studied. Negative connotations of red include associations with danger, anger, and aggression (see Elliot and Maier 2014 for a review), but red has also been associated with positive connotations such as elated joy (Dael et al. 2016), excitation and cheerfulness (Wexner 1954), love (Collier 1996), and romantic attraction (Elliot and Niesta 2008). When asked to name a colour for an emotionally-charged word, red was often named first for negative words and

named second for positive words (Sutton and Altarriba 2016). Thus, red seems to have heterogeneous, often context-dependent connotations that have so far been explained by only few scholars (Buechner, Maier, Lichtenfeld, and Schwarz 2014, Elliot and Maier 2012). In a recent account, Buechner and colleagues (2014) argued that the colour red functions as a relevance signal and increases attention-capture to affective, goal-related stimuli. These goals can be both positive (romantic/friendly affiliation) and negative (avoiding threat). Heterogeneous affective connotations have also been reported for other colours such as for blue (calmness or soothing in Hemphill 1996; Wexner 1954; creativity in Mehta and Zhu 2009; sadness in Palmer, Schloss, Xu, and Prado-Leon 2013; panic fear in Dael et al. 2016) or yellow (happy and cheerful in Palmer et al. 2013; Wexner 1954; but low on pleasantness in Simmons 2011; Valdez and Mehrabian 1994). Accepting this heterogeneity, one has to ask whether (or how, when, and where) colour can consistently impact cognitive and affective processes.

2.2 *Operationalization in the affective sciences*

This last question leads us to the point of operationalization (i.e., defining abstract concepts into measurable variables) in the affective sciences where theorization and research about various aspects of affect and emotion are differentiated more thoroughly than what we encounter in the colour literature. Sub-categorizations of *affect* distinguish between phenomena such as emotions, mood, preferences, and attitudes (see Davidson, Scherer, and Goldsmith 2003; Scherer 2005). For example, whereas mood describes loose, long-lasting affective responses that do not have a particular origin, emotions describe short-lived, intense affective responses

consequent to a defined internal or external situation (Beedie, Terry, and Lane 2005; Rosenberg 1998). Also, different theories of emotion favour categorical, dimensional, or a process approach for conceptualizing the structure and differentiation of emotions (Moors 2009; Rosenberg 1998; Russell and Barrett 1999; Sander and Scherer 2009). However, the underlying mechanisms of emotion and affect have been hardly accounted for when trying to understand observed differences in colour-affect relationships (e.g. Elliot and Maier 2014, but see for example Buechner et al. 2014, for a related attention-motivational account). Yet, the field of affective assessment has produced many different protocols operationalizing the above-mentioned concepts and models (see Scherer 2005 for a review). As soon as two studies have different protocols, they may target different mechanisms (e.g. mood or emotion, elicitation, or mere concept activation) leading to different results that are hard to compare.

Because mechanisms behind colour-affect associations also relate to aesthetic responses to colour, one must also consider the contribution of research on colour preferences. A preference can be defined as a relatively stable evaluative judgment in the sense of liking or disliking a stimulus, generating unspecific positive or negative feelings (Scherer 2005). Recent theories on colour preferences rely on the ecological valence theory (EVT; Palmer and Schloss, 2010), which assumes that basic valenced (i.e., positively or negatively charged) experiences involving colours are at the origin of colour preferences. Thus, if a person has repeated positive emotional experiences with something coloured (e.g. eating tasty strawberries), such repeated experiences lead to a general liking of this colour (red in this case). Having negative emotional experiences with something coloured (e.g. biting in rotten food), this would reduce the liking of that colour (brown in this case). Examples to support the EVT mainly focus on object-based emotional experiences, but do not exclude abstract, concept-

based experiences. The latter refers to affective responses towards an entity that does not have a physical form (such as symbolic meaning). Thus, affective states elicited by concept-based experiences may contribute to the liking of particular colours (e.g. feelings of affiliation to a political party such as democratic or republican institution, see Schloss and Palmer 2014). For example, Swiss participants provided about 20% object-based associations and about 38% concept-based associations as reasons for generally preferred colours, this ratio was roughly comparable (although generally lower) for generally least preferred colours (Jonauskaite et al. 2016). Finally, affective symbolic associations appear to be relatively strong in Japan and China (e.g. red representing good luck), which may explain cultural differences in colour preferences (i.e., higher liking of red) when compared with participants from the US (Yokosawa, Schloss, Asano and Palmer 2015).

2.3 *Cross-cultural and cross-linguistic differences*

The above examples regarding cultural beliefs shaping colour preferences bring us to the last point: cross-cultural and cross-linguistic comparisons. Some colour associations might be the same across cultures and languages while others might apply to particular populations and languages only (Adams and Osgood 1973; D'Andrade and Egan 1974; Hupka et al. 1997; Madden et al. 2000; Ou et al. 2004; Palmer, Schloss, Guo, Wung and Peng 2015; Yokosawa et al. 2015). For example, Hupka and colleagues (1997) assessed to what extent five nations differentially associated four discrete emotions (anger, envy, fear, and jealousy) to 12 colour terms. Some emotions were associated with the same colour across cultures/languages (anger with red and black, fear with black, jealousy with red), while these same

emotions and one other emotion (envy) were also connected to different colours across cultures/languages (e.g. jealousy and envy with yellow in Germany for German speakers). Much in line with the seminal work of Osgood and his collaborators (1957, 1975), Hupka and colleagues (1997) suggested that "cross-modal associations originate in universal human experiences and in culture-specific variables, such as language, mythology, and literature" (p. 156). That way, semantically unrelated concepts (e.g. colour term *yellow*, emotion word *joy* or *envy*) may become associated through correlated perceptual experiences (e.g. sunny weather) or cultural-historical variables (e.g. "to turn yellow with envy" in German literature, blue depictions of The Virgin Mary representing purity). In the future, we need to disentangle the universal and cultural pattern of associations that coloured features may have with affective states and processes.

To conclude, colour psychology research has much to offer, but the current knowledge originating from various paradigms and definitions is insufficiently or incorrectly transferred to guide the public interested in making appropriate colour choices for their immediate environments. We need more comprehensive studies on colour-affect relationships – separating whether colours are shown or linguistically represented, what type of affect is targeted, and whether any finding is consistent across cultures and/or languages. It is for that reason that we started a large-scale cross-cultural online survey on linguistic representations of colour-emotion links. We were particularly interested in how colour concepts link to a large number of emotions across cultures and languages.

3. Description of the international colour-emotion association survey

Our long-term plan is to accumulate data on colour-emotion links on an international scale, and to do so for linguistic and physical representations of colours. Once this knowledge has been gathered, the research community can start to contextualize this knowledge, bringing it to applied settings. We thus started an online survey, mainly because this method can easily provide data from numerous cultural, linguistic, and demographic groups. We decided to start this project by using colour terms since at this stage it is not technically feasible to reliably manipulate colour presentation online across many computer monitors.

We present participants with 12 colour terms (*red, pink, blue, purple, brown, orange, yellow, green, turquoise, grey, black, and white*) in their native language (currently the survey is available in 37 languages). These terms were selected based on previous colour psycholinguistic research. We included 11 basic colour terms used across many languages (Kay, Berlin, Maffi, Merrifield, and Cook 2009; Lindsey and Brown 2006, 2009). We also included *turquoise* as a potentially emerging basic colour term in English (Mylonas and MacDonald 2016). Participants indicate for each colour term which emotion(s) they associate with this colour term and how intense this associated emotion is. To do so, participants see words representing 20 discrete emotions in a circular arrangement as shown in Figure 1 (for details on rationale and validation see Scherer 2005, Scherer, Shuman, Fontaine, and Soriano 2013). Participants can indicate no emotion, associate one or several of the displayed emotions and rate their intensity, or list another emotion in the pop-up window without rating its intensity. Participants are asked to complete the survey in their native language and to provide socio-demographic information (e.g. age, gender,

colour vision acuity). In Figure 2, we display the actual status of data collection, which countries are involved, and an approximate count.
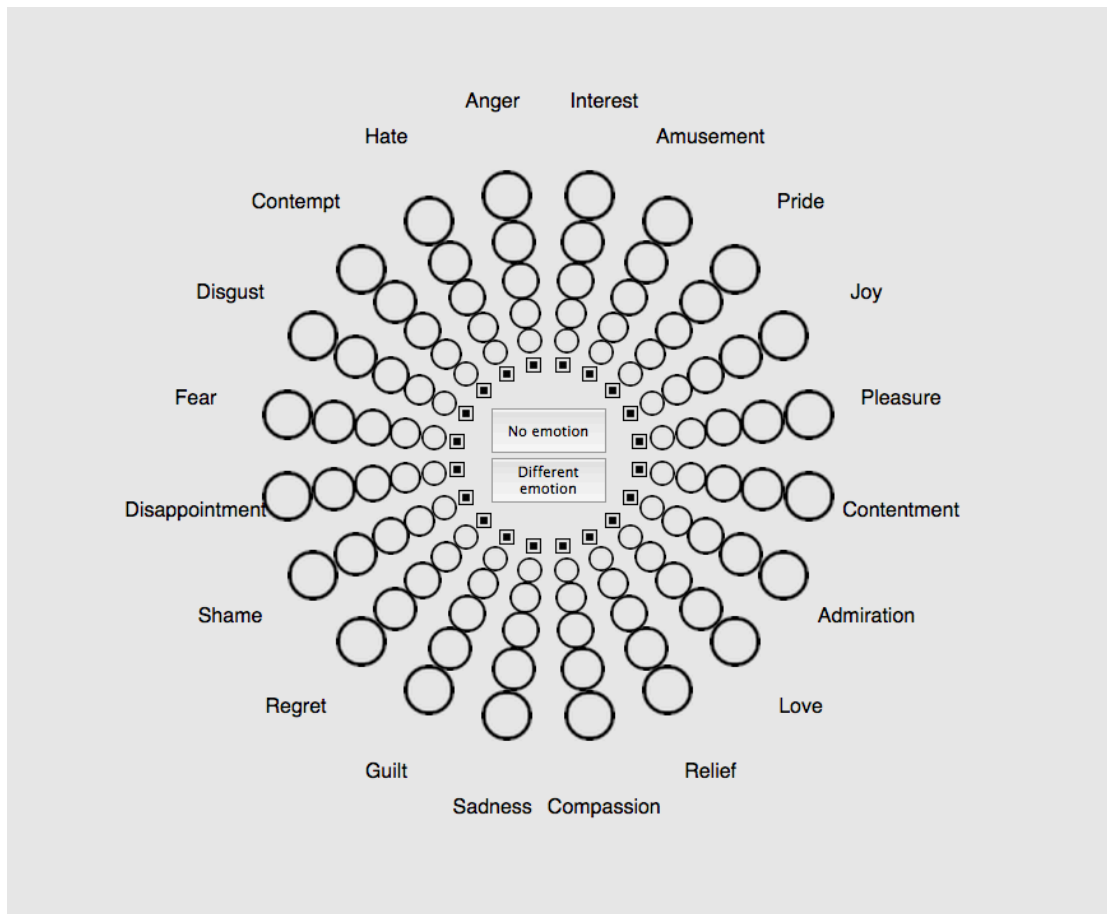

Figure 1. The wheel-shaped rating scale used to assess which emotions (and of what intensity) are associated with colour terms

We argue that we do not have sufficient systematic research available to formulate clear-cut hypotheses, in particular when considering our rationale outlined above. Yet, for the colour concept *red*, we expect cross-culturally strong emotions of either valence (positive and negative), and specifically to love and anger (see above). These emotions might have biological origins (Changizi, Zhang, and Shimojo 2006). We expect, however, influence of cultural-historical variables too. Red is symbolic for good luck in China, likely resulting in joy connotations in Chinese participants.

Given the heterogeneity of the literature and relative scarcity in the number of emotional associations previously tested, our aim is rather to produce a comprehensive inventory of a potentially wide range of fundamental colour-affect associations.

In the long term, our research program aims to facilitate controlled comparison of results on colour-affect relationships. We below repeat the three points we highlighted to enhance future research scrutiny. Firstly, the colour-emotion association survey presented above should be repeated by physically showing colour patches. When doing so, we need to standardize the precise colours (e.g. chroma meter) presented on calibrated computer screens. We can test whether conclusions are comparable for colour patches (physical presentation) and colour terms (linguistic presentation). Regarding the affective processes involved, we currently test semantically associated, not necessarily felt, emotions. Here, we used a paradigm that allows us to analyse the data according to a discrete approach (specific emotions) and dimensional approach (grouping emotions along projected similarities such as intensity, valence (i.e., positive-negative), arousal (i.e., calm-excited), see Scherer 2005). Future studies will need to target other types of affect such as mood, and also consider subjective experiences while exposed to colour. Thirdly, considering the carefully translated survey and the socio-demographic information, we can understand cross-cultural differences and modifications by for example linguistic, cultural, or gender variables.
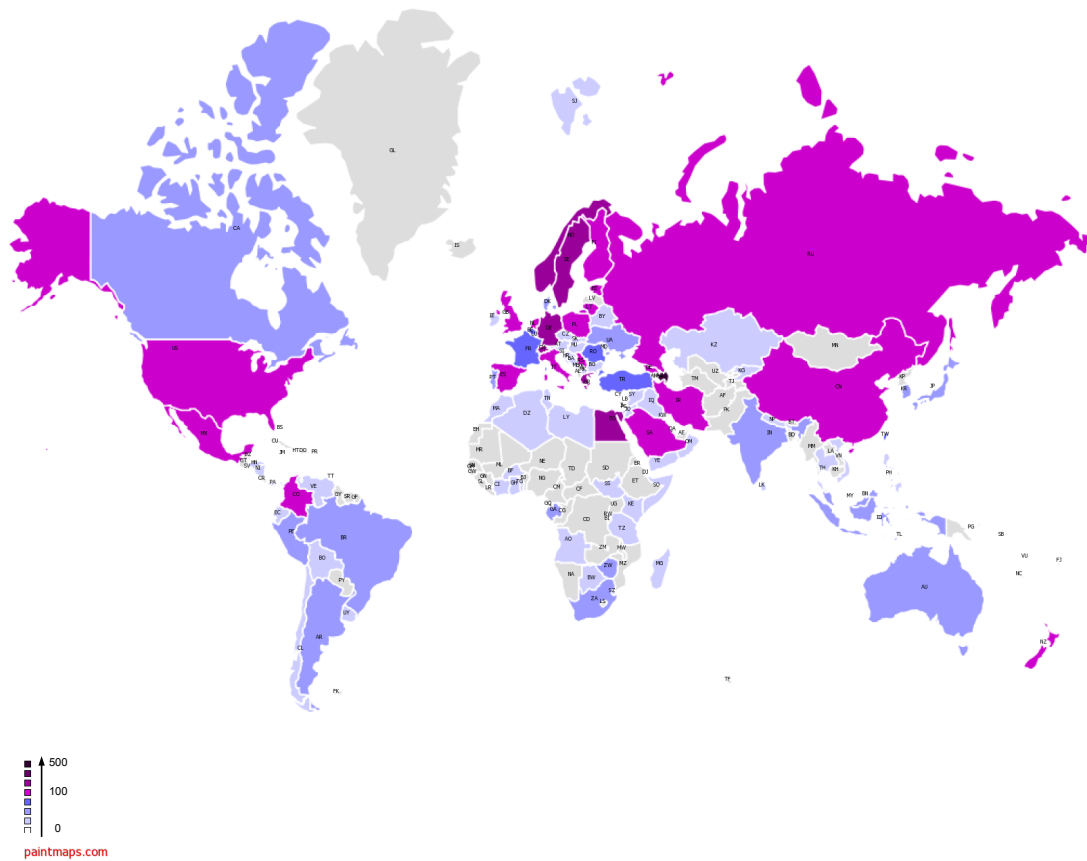
Figure 2. World map marking the countries where data have been collected by August 2017. Countries in purple represent a complete sample of respondents was obtained (minimum 30 participants in each of the age groups 18-30, 30-50 and over 50 years). In blue countries are indicated with ongoing but incomplete data collection. Grey indicates countries which do not yet have responses from.

4. Conclusion

The public shows a desire to be advised on making adaptive colour choices depending on aspired affective-cognitive functions. Studies on colour applied in real-world

contexts overly extrapolate conclusions from psychological research, which shows more heterogeneity than is often assumed. Colour-emotion associations certainly are systematic, but the diversity of paradigms (perceptual, conceptual) and confusion of concepts (defining colour and affective attributes) may explain why many results in the field are contradictory. Increasing our understanding of the links between colour and emotion requires, in our view, a theoretically grounded and large-scale approach to map a comprehensive range of colour-emotion associations. To this end, we are running an online survey where we assess linguistic representations of colour-emotion associations across cultures and languages. Knowledge gathered from these data as well as from targeted variations to its paradigm (e.g. by using physical colours) can be used by the research community to foster further research (for example on the origins of colour preferences), and to reliably compare with results to applied contexts.

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