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Lithuanian Conceptual Colour–Emotion Associations in the Global Context of 37 Nations

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Abstract. *Red with anger* or *green with envy* – such metaphors link colours and emotions. While such colour metaphors vary across languages, conceptual associations between colours and emotions have many cross-cultural similarities. Here, we took published data from 8615 participants (2172 men) coming from 37 nations (i.e., Austria, Azerbaijan, Belgium, China, Colombia, Croatia, Cyprus, Egypt, Estonia, Finland, France, Georgia, Germany, Greece, India, Iran, Israel, Italy, Japan, Latvia, Lithuania, Mexico, Netherlands, New Zealand, Nigeria, Norway, Philippines, Poland, Russia, Saudi Arabia, Serbia, Spain, Sweden, Switzerland, Ukraine, United Kingdom, and United States) and analysed Lithuanian (n = 217) associations between colour terms and emotion concepts. Lithuanians had many associations, the most frequent being *red–love*, *yellow–amusement*, *yellow–joy*, and *black–sadness* (all endorsed by > 60% of participants). While Lithuanians associated more emotions with colours than the other participants, the Lithuanian pattern of these associations was highly similar to the global pattern (r = .92). When compared to each other nation individually, colour–emotion association pattern similarities ranged between .65 and .89. Lithuanian patterns were the most similar to the Russian and the least similar to the Egyptian ones. Crucially, such similarities could be predicted by linguistic but not geographic distances. Nations speaking languages linguistically closer to Lithuanian also displayed more similar colour–emotion association patterns. These results support universality of colour–emotion associations and point to small but meaningful cultural differences (e.g., *red* represented *love* more strongly than *anger* for Lithuanians but not globally). Future studies should look whether colours can modulate emotions, or whether such associations are purely abstract.

Keywords: colour, affect, emotion, semantic associations, cross-cultural, Lithuania.

Lietuvių spalvų ir emocijų koncepcinės asociacijos pasauliniame 37 tautų kontekste

Santrauka. *Pabalti iš pykčio* ar *pažaliuoti iš pavydo* – tai metaforos, siejančios spalvas ir emocijas. Nors tokios spalvų metaforos įvairiose kalbose skiriasi, psichologinės spalvų ir emocijų asociacijos turi daug tarpkultūrinių panašumų. Čia pasinaudojome anksčiau skelbtais 8 615 dalyvių (2 172 vyrų), kilusių iš 37 šalių (t. y. Austrijos, Azerbaidžano, Belgijos, Egipto, Estijos, Filipinų, Graikijos, Gruzijos, Indijos, Irano, Ispanijos, Italijos, Izraelio, Japonijos, Jungtinės Karalystės, Jungtinių Amerikos Valstijų, Kinijos, Kolumbijos, Kroatijos, Kipro, Latvijos, Lenkijos, Lietuvos, Meksikos, Naujosios Zelandijos, Nigerijos, Nyderlandų, Norvegijos, Prancūzijos, Rusijos, Saudo Arabijos, Serbijos,

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Suomijos, Švedijos, Šveicarijos, Ukrainos ir Vokietijos), duomenimis ir analizavome, kokias asociacijas lietuviams (n = 217) kelia spalvų terminai ir emocijų konceptai. Lietuviai turėjo daug asociacijų, iš kurių dažniausios buvo *raudona-meilė*, *geltona-linksmumas*, *geltona-džiaugsmas* ir *juoda-liūdesys* (visas šias asociacijas pasirinko daugiau kaip 60 % dalyvių). Nors lietuviai su spalvomis siejo daugiau emocijų nei kiti dalyviai, lietuviškas šių asociacijų reljefas buvo labai panašus į pasaulinį (r = 0,92). Lyginant su kiekviena kita tauta atskirai, spalvų ir emocijų asociacijų reljefų panašumas svyravo nuo 0,65 iki 0,89. Lietuvių reljefas buvo panašiausias į rusų, o mažiausiai panašus – į egiptiečių. Šiuos panašumus buvo galima nuspėti pagal kalbinius, bet ne geografinius atstumus. Tautos, kalbančios lingvistiškai artimesnėmis kalbomis, taip pat pasižymėjo panašesnėmis spalvų ir emocijų asociacijomis. Šie rezultatai patvirtina spalvų ir emocijų asociacijų universalumą ir rodo nedidelius, bet reikšmingus kultūrinius skirtumus (pvz., *raudona* spalva lietuviams reiškė *meilę* labiau nei *pyktį*). Ateityje reikėtų išsiaiškinti, ar spalvos gali paveikti emocijas, ar visgi tokios asociacijos yra visiškai abstrakčios.

Pagrindiniai žodžiai: spalvos, emocijos, semantika, tarpkultūrinė psichologija, Lietuva.

Introduction

Colours and emotions are linked in languages and traditions. Our successes are marked in green and errors in red. We send red roses to our true loves, and we speak in "coloured" language. Lithuanians fear for black days (*juoda diena*), get red when embarrassed (*raudonuoti*), work blackly (*juodai dirbti;* i.e., work hard), and do not want to be a white crow (*balta varna;* i.e., an ugly duckling) or a green cucumber (žalias kaip agurkas; i.e., novice) (Kosova & Klanauskaitė, 2015; Roch, 2015). Lithuanians are one of the few to express degrees of anger through colour – from white, to red, to blue and black (*pabalęs/įraudęs/pamėlęs/pajuodęs iš pykčio*) (Sirvydė, 2007). This is unlike the English speakers, who express degrees of anger through shades of *red* (*flushed/pink/red/scarlet with anger*) (Sirvydė, 2007), also discussed in (Soriano & Valenzuela, 2009). While there are clear differences in how colour is used metaphorically in languages (e.g., Iljinska & Platonova, 2017; Kalda & Uusküla, 2019; Kosova & Klanauskaitė, 2015; Philip, 2006), empirical research in psychology has revealed many commonalities across nations (Adams & Osgood, 1973; Jonauskaite et al., 2020; Ou et al., 2018). Here, we aim to describe Lithuanian colour–emotion associations, and compare them to colour–emotion associations collected from other 36 nations.

When it comes to colour–emotion associations globally, previous studies linked red to *love* and *anger*, pink to *love,* yellow to *joy*, brown to *disgust*, and black with *sadness* (Fugate & Franco, 2019; Jonauskaite et al., 2020; Jonauskaite, Wicker, et al., 2019; Kaya & Epps, 2004). Darker colours were associated with more negative emotions and lighter colours with more positive emotions (Adams & Osgood, 1973; Meier et al., 2007; Specker et al., 2018). *Red* and *black* were arousing and powerful while *blue* and *green* were calming (Adams & Osgood, 1973; Kaya & Epps, 2004; Valdez & Mehrabian, 1994). Importantly, many of such associations were stable cross-culturally, testing participants from over 30 nations (Adams & Osgood, 1973; D'Andrade & Egan, 1974; Jonauskaite et al., 2020, 2023; Jonauskaite, Wicker, et al., 2019; Ou et al., 2018; Specker et al., 2018).

In the seminal study, Adams and Osgood (1973) asked students from 23 countries to rate seven colour terms on the semantic differential scales loading on valence (positive–

negative), arousal (arousing–calming), and power (strong–weak).[1] They found similar affective ratings of colours across the studied countries (e.g., black was *negative* and *strong*, red was *strong* and *arousing*). In a more recent study, Jonauskaite and colleagues (2020) assessed associations between 12 colour terms and 20 emotion concepts in representative samples of participants from 30 nations, which also included Lithuania. They reported a high degree of similarity in the patterns of associated emotions. The pattern of Lithuanian colour–emotion associations had 0.92 correspondence with the pattern of all other participants. In a subsequent study, also including Lithuania, a high degree of consistency across the lifespan, testing 16–88-year-old participants, was also observed (Jonauskaite et al., 2023).

Beyond universally understood colour–emotion associations, there are small but meaningful cultural differences. These differences might be driven by culture-specific variables such as environmental conditions or locally spoken languages (e.g., see Hupka et al., 1997; Kawai et al., 2023; Soriano & Valenzuela, 2009). Two large-scale studies supported both suppositions. Regarding environmental conditions, across 55 countries, participants living in countries closer to the equator (i.e., warmer) and with lower annual precipitation levels (i.e., dryer) were less likely to associate the colour term *yellow* with the concept of *joy* (Jonauskaite, Abdel-Khalek, et al., 2019). Regarding spoken languages, across 28 countries and 16 languages, participants whose languages labelled the PURPLE category with the cognate of *purple* (e.g., English) associated more positive and empowering emotions than those labelling the PURPLE category with a cognate of *violet* (e.g., French – *violet*, Lithuanian – *violetinė*) (Uusküla et al., 2023).[2] Even more generally, across 30 nations, lower linguistic and geographic distance predicted higher similarity in colour–emotion association patterns (Jonauskaite et al., 2020).

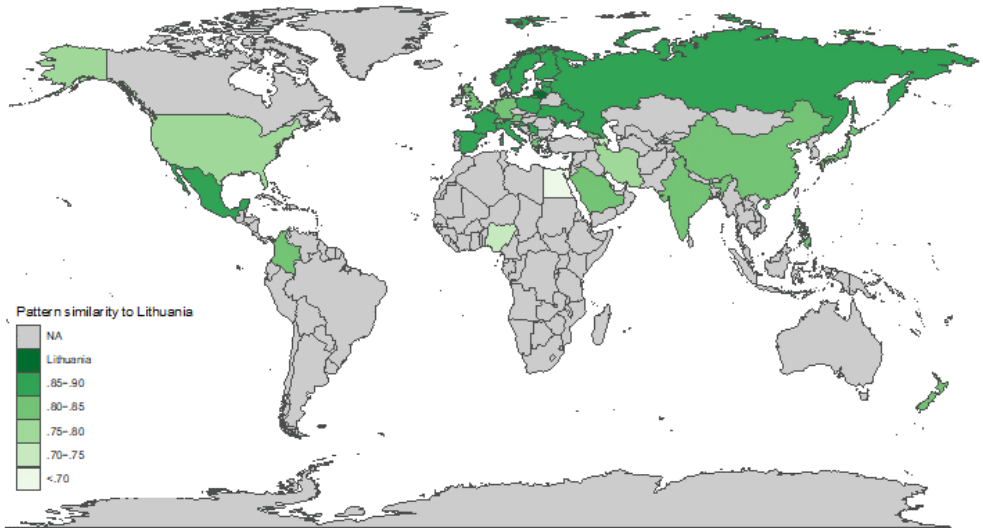
Previous studies looked for global cross-cultural patterns (Adams & Osgood, 1973; Jonauskaite et al., 2020, 2023; Ou et al., 2018) and also identified some cultural differences (Hupka et al., 1997; Jonauskaite, Abdel-Khalek, et al., 2019; Kawai et al., 2023; Uusküla et al., 2023). Here, we took a closer look at Lithuanian colour–emotion associations and compared them to the associations obtained from 36 other nations. We tested whether geographic or linguistic closeness could predict similarity in these associations. To this end, in addition to Lithuanian participants, we recruited participants from neighbouring nations (i.e., Latvia, Poland, Russia), other European nations (e.g., Estonia, Germany, France, Switzerland), and nations located on other continents (e.g., USA, Mexico, Colombia, Nigeria, China, India, Japan, New Zealand; see all nations in Figure 1).

[1] They called valence dimension *evaluation*, arousal dimension – *activity,* and power dimension – *potency*. We refer to these dimensions using a more recent nomenclature (Fontaine et al., 2007), to keep consistency across articles.

[2] Cognates are words that are phonologically and/or orthographically similar (e.g., *red* in English, *raudona* in Lithuanian, *rouge* in French, *rot* in German). Likely, they also have a common etymological origin.

Figure 1

Map of the 37 studied nations, and how similar their colour–emotion associations were to the Lithuanian ones



Note. NA = no data from those countries (see also Figure 4).

Method

Participants

We took previously published data from (Jonauskaite et al., 2020, 2023). In total, there were 8615 participants (2172 men, 6389 women, 54 did not report their gender), including 217 Lithuanian participants (40 men, 177 women). Participants' mean age was 35.46 years (*SD* = 15.66 years, range = 15–88 years). Participants came from 37 nations and spoke 25 languages (see all demographic data in Table 1 and Figure 1). The data had been pre-selected, taking only participants who originally came from one of the 37 countries and who completed the study in their native language. To take Lithuania as an example, only participants who reported that their country of origin was Lithuania, their native language was Lithuanian, and who completed the study in Lithuanian were included. We did not consider their residence country, meaning that some participants might have resided in other countries. Two exceptions were Nigerian and Indian participants, who completed the study in English (the official language; see all languages in Table 1). All participants were highly fluent in their respective languages, with the self-rated mean language fluency score of 7.85 out of 8. All participants took part voluntarily and were not remunerated for their participation. The study was conducted in accordance with the principles expressed in the Declaration of Helsinki (World Medical Association, 2013) and was approved by the local ethics committee (C_SSP_032020_00003).

Table 1

Demographic information of all participants, separated by nation

Nation	Language	*n*	Gender		Age (in years)		Linguistic distance	Geographic |distance (km)
			% men	% women	Mean	SD		
Austria	German	187	17.11	81.28	34.53	15.47	.363	1161.9
Azerbaijan	Azerbaijani	490	26.12	73.67	36.15	13.80	.536	2426.2
Belgium	Dutch	88	22.73	77.27	38.38	17.09	.353	1438.1
China	Mandarin Chinese	227	28.63	70.93	33.27	18.88	.558	6318.8
Colombia	Spanish	113	45.13	54.87	35.53	14.82	.381	10010.6
Croatia	Croatian	74	16.22	83.78	38.82	12.94	.226	1287.7
Cyprus	Greek	264	23.86	76.14	30.11	13.91	.407	2372.6
Egypt	Arabic	209	30.62	69.38	30.53	12.45	.515	3260.3
Estonia	Estonian	286	10.84	89.16	39.22	12.08	.554	354.3
Finland	Finnish	140	12.14	87.14	31.92	14.37	.534	896.4
France	French	246	28.86	69.92	36.63	15.72	.351	1885.6
Georgia	Georgian	127	28.35	70.87	32.73	15.04	.537	2094.2
Germany	German	455	19.12	80.66	35.52	15.49	.363	1133.9
Greece	Greek	613	16.97	82.71	30.09	10.97	.407	1896.1
India	English	103	35.92	64.08	38.43	18.61	.381	5854.1
Iran	Persian	121	11.57	88.43	31.23	10.31	.382	3485.0
Israel	Hebrew	104	16.35	83.65	42.52	14.57	.555	2850.1
Italy	Italian	172	31.98	68.02	39.05	16.19	.292	1667.8
Japan	Japanese	145	53.10	44.14	41.87	13.80	.598	8199.9
Latvia	Latvian	167	18.56	80.24	38.61	13.84	.030	186.6
Lithuania	**Lithuanian**	**217**	**18.43**	**81.57**	37.18	15.42	**0**	**0**
Mexico	Spanish	381	34.12	65.62	39.36	18.97	.381	9871.4
Netherlands	Dutch	97	34.02	65.98	42.64	17.93	.353	1243.5
New Zealand	English	172	25.00	74.42	24.85	10.13	.381	17282.0
Nigeria	English	132	44.70	55.30	38.15	12.73	.381	5301.3
Norway	Norwegian	405	17.53	81.48	39.19	15.45	.381	1039.3
Philippines	English	275	26.91	70.55	34.12	16.51	.381	9316.7
Poland	Polish	302	28.15	71.85	42.63	19.49	.257	515.7
Russia	Russian	175	36.57	62.86	36.47	17.45	.211	4250.2
Saudi Arabia	Arabic	234	33.33	66.24	30.56	15.49	.201	3843.2
Serbia	Serbian	110	23.64	76.36	39.37	16.57	.388	1351.1
Spain	Spanish	173	23.70	75.72	33.90	12.98	.381	2706.4
Sweden	Swedish	327	16.51	81.96	37.39	15.18	.515	841.5
Switzerland	French	610	29.67	69.67	25.92	12.20	.351	1486.2
Ukraine	Ukrainian	95	16.84	83.16	40.55	23.01	.243	946.9
United Kingdom	English	299	29.43	68.90	44.12	16.90	.381	1663.0
United States	English	280	27.50	70.71	31.79	16.10	.381	8176.6
Together	-	8615	25.21	74.16	35.23	15.87	-	-

Note. *n* = number of participants. Geographic distances were measured in kilometres from population centres between Lithuania and each other nation. Linguistic distances between Lithuanian and each other language were extracted from (Jäger, 2018), and ranged between 0 (i.e., identical languages) and 1 (i.e., totally dissimilar languages). Scores below 0.24 indicate linguistic relatedness.

Measures

Colour Stimuli

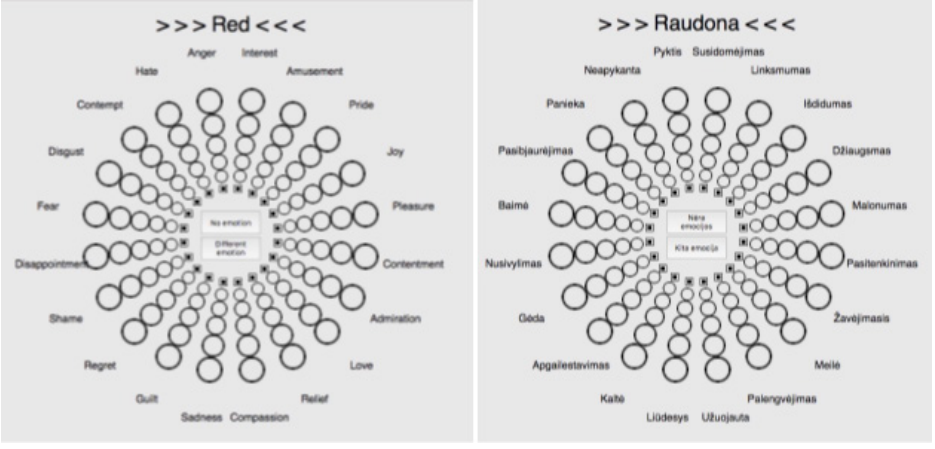
Most Indo-European languages have 11 basic colour terms (Berlin & Kay, 1969), meaning they are understood by all native speakers and are in principle sufficient to divide the colour space. In English, those terms are *red, orange, yellow, green, blue, purple, pink, brown, white, grey, black*[3] (Lindsey & Brown, 2014; Mylonas & MacDonald, 2015). Lithuanian, just like Russian, Greek, Italian and Spanish, possesses an additional 12th basic colour term for the LIGHT BLUE (TURQUOISE) colour category – *žydra* in Lithuanian, *goluboj* in Russian, *yalazio* in Greek (Androulaki et al., 2006; Lillo et al., 2018; Paggetti et al., 2016; Paramei, 2005; Uusküla & Bimler, 2016). To account for all basic colour terms, we used 12 colour terms (words) as stimuli, always presented in the native languages of our participants – RED, ORANGE, YELLOW, GREEN, TURQUOISE, BLUE, PURPLE, PINK, BROWN, WHITE, GREY, and BLACK. In Lithuanian, these terms are *raudona, oranžinė, geltona, žalia, žydra/turkio, mėlyna, violetinė, rožinė, ruda, balta, pilka, juoda* (see those terms in other languages in (Jonauskaite et al., 2020, 2023).

Emotion Assessment

The Geneva Emotion Wheel (GEW, version 3.0; Scherer, 2005; Scherer, Shuman, Fontaine, & Soriano, 2013) is a self-report measure of emotion, containing 20 emotions (Figure 2). These emotions are represented along the circumference of a wheel, organized around two axes – valence (horizontal: positive vs. negative) and power (vertical: high power vs. low power). Emotions similar in valence and power are placed close to each other. Circles of increasing size connect the centre of the wheel with the circumference of the wheel,

Figure 2

The Geneva Emotion Wheel (GEW) in English and Lithuanian, with an example for RED



[3] We followed norms in linguistics to refer to colour terms in *italics* and to conceptual colour categories in CAPITAL letters. In this way, RED is the colour category named as *red* by English speakers, *raudona* by Lithuanian speakers, and *rouge* by French speakers.

signifying five degrees of emotion intensities (1–5). See Figure 2 for the emotion terms in English and Lithuanian and previous studies for emotion terms in the other languages (Jonauskaite et al., 2020, 2023).

Procedure

In the previous studies (Jonauskaite et al., 2020, 2023), the data were collected online on a custom-built website. Participants were given information about the study and provided informed consent. After passing the verification check, participants saw 12 colour terms in random order and were asked to associate one, several, or none of the GEW emotions with each colour term. They also rated intensity of the associated emotions. They could choose "No emotion" or "Different emotion" for each colour term (see the different emotions in Lithuanian in Table A 1).

More precisely, participants received these instructions:

> You will see different colour words in no particular order. For each colour word, please use the emotion wheel (see below) to indicate which emotion or emotions are for you best represented by that colour word.
>
> Each spike in the wheel represents an emotion, for example "anger" as indicated, or a closely related emotion (e.g., irritation, a type of anger). Please rate the intensity of each emotion (one or more) that you associate with the particular colour word shown above the wheel. Smaller circles indicate weaker emotions and larger circles indicate stronger emotions. You can correct your choice by clicking on the small square at the hub of the wheel, meaning that this emotion is *not* associated with the colour word.
>
> Click on "No emotion" if you do not associate any emotion with the given colour word. If you associate that colour word with another emotion that is not displayed in the wheel, please click on "Different emotion". You will be asked to write down the emotion(s) in the pop-up window.

Data Analysis

In the previous studies, the data had been pre-cleaned by excluding participants who were too quick or too slow (i.e., took less than 3 or more than 90 min), or did not show minimal engagement with the online experiment (i.e., spent less than 20 s on the first four colour terms). Some participants had missing data on some of the colour terms, and we included them if no more than four (i.e., 33%) of colour terms had missing data. Access data here: https://osf.io/2w6gh/?view_only=e992cdbb920c433395808f34a3d4c9bd

Patterns of Colour–Emotion Associations

We calculated proportions of participants associating each colour term with each emotion concept in the following way. For each colour–emotion combination (e.g., RED and *anger*), we calculated the number of participants who chose the particular emotion concept (i.e., *anger*) and divided by the total number of participants. We repeated this procedure for all 240 colour–emotion associations (i.e., 12 colour terms x 20 emotion concepts)

and combined these proportions to make the patterns of colour–emotion associations. We established colour–emotion association patterns for each nation separately as well as for all nations together (but without Lithuania).

Geographic and Linguistic Distances

We calculated geographic distances in kilometres between the centre of Lithuania vs. the centres of each other nation (see Table 1). We used population-weighted geographic centres instead of unweighted geographic centres to account for an uneven distribution of inhabitants in some countries. While such calculation had little effect on the central point of Lithuania and many other smaller countries, it affected larger countries, such as Russia, where the majority of the population is located in one part of the country. See all geographic distances to Lithuania in Table 1.

We extracted linguistic distance scores between the Lithuanian language and the national language of each other nation from Jäger (2018), capturing the phylogenetic distances between languages from lexical sources. The original linguistic distances ranged from 0 to 1, with lower linguistic distance scores indicating higher linguistic similarities. However, as the linguistic distances were not evenly spread across this range, we followed a previous publication (Jonauskaite et al., 2020) and used a power transform to the fourth power (^4) of the original distances. Languages belonging to the same language family (i.e., Indo-European) or even the same linguistic group (i.e., Baltic languages) had lower linguistic distance scores than languages from other language families (e.g., Uralic, Afro-Asiatic, Sino-Tibetan). While Jäger (2018) proposed that language pairs with distances below .7 should be considered as related, after the power transformation, such criterion became .24 (i.e., 0.74^4). See all linguistic distances to Lithuanian in Table 1.

Results

Lithuanian Colour–Emotion Associations

On average, Lithuanian participants associated 4.01 emotion concepts ($SD = 4.60$, range = 0–20) with each colour term. This number was higher than that on average, $t(2686) = 8.56$, $p < .001$, whereby other participants associated 3.23 emotion concepts ($SD = 3.61$, range = 0–20), suggesting that Lithuanians were more likely to link colours with emotions than other participants.

The most frequent associations, endorsed by 50% or more of the participants, were the following:

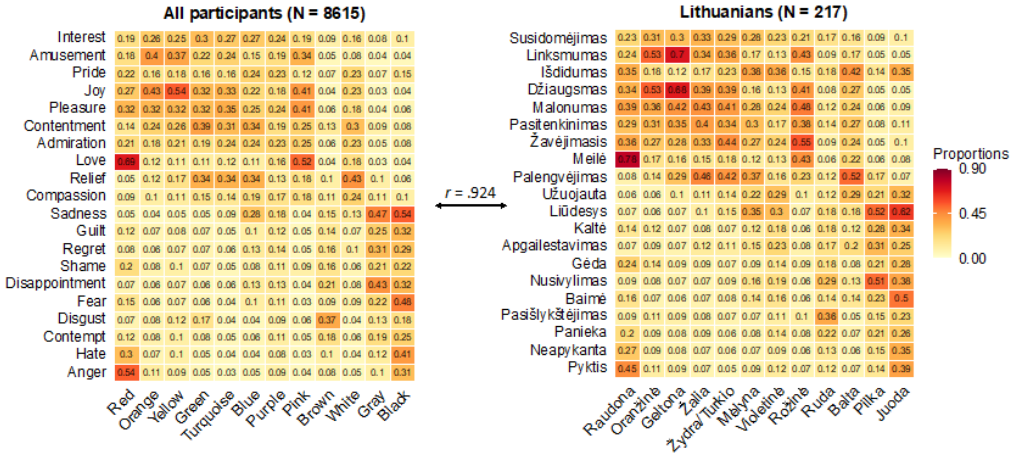
- RED and *love* (77.9%),
- YELLOW and *amusement* (70.0%),
- YELLOW and *joy* (68.2%),
- BLACK and *sadness* (61.8%),
- PINK and *admiration* (55.3%),
- ORANGE and *joy* (53.2%),
- ORANGE and *amusement* (52.5%),

- WHITE and *relief* (51.6%),
- GREY and *sadness* (51.6%),
- GREY and *disappointment* (51.6%),

However, many more emotion concepts were associated at lower proportions (see all of them in Figure 3).

Figure 3

Colour–emotion associations of all participants (left) and the Lithuanian participants (right)



Note. Redder cells indicate associations endorsed by a larger number of participants while proportions go from 0 (no one endorsed) to 1 (everyone endorsed this colour–emotion association). *r* = Pearson correlation between the two colour–emotion association patterns.

Lithuanian Colour–Emotion Associations in the Global Context

We used Pearson correlations to compare the Lithuanian colour–emotion association pattern (see Figure 3) with analogous association patterns of i) all the remaining participants taken together (global pattern), and ii) with patterns of each of the remaining nation.

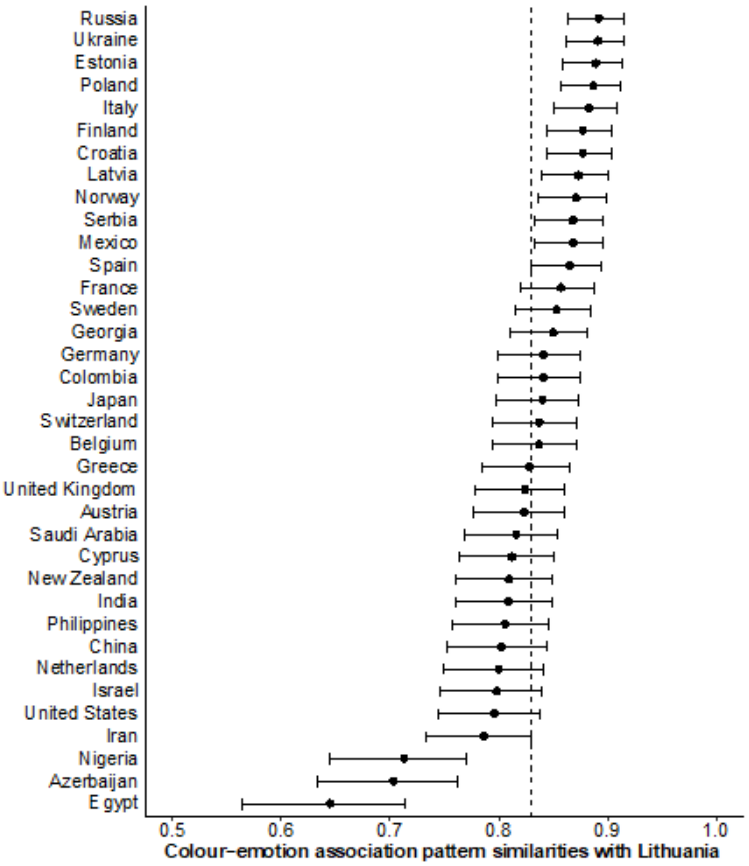
Regarding the comparison with the global pattern, Lithuanian associations were highly correlated ($r = .924$, $p < .001$; Figure 3). Visually, the two patterns appeared highly similar, apart from the fact that Lithuanians were more likely to associate colours with emotions and thus resulted in higher proportions overall (i.e., darker cells). Still visually, it seemed that more Lithuanians linked RED with *love* than *anger*, while globally, both emotions were associated at similar frequencies with RED. It also seemed that Lithuanians associated *pride* and *compassion* with BLACK, in addition to the more common emotions like *sadness*, *fear*, *anger*, *guilt*, *disappointment*, and *hate*. *Amusement* was particularly strongly linked to YELLOW, in addition to *joy*, while globally YELLOW–*joy* association was more frequent.

Regarding the comparison with each of the other nations individually, the mean correlation was $r = .830$ (see Figure 1 and Figure 4). These correlations ranged from $r =$

.645 to r = .892, suggesting a high degree of pattern similarity (1 = identical patterns). All correlations were statistically highly significant, $p < .001$. Lithuanian colour–emotion associations were the most similar to those of Russian, Ukrainian, Estonian, Polish, and Italian participants. Lithuanian colour–emotion associations were the least similar to those of Egyptian, Azerbaijani, and Nigerian participants (Figure 4).

Figure 4

Colour–emotion association pattern similarities between Lithuanian colour–emotion associations and those of the remaining 36 nations.



Note. Correlations closer to 1 indicate higher similarity with Lithuanian associations. Vertical line marks mean correlation (r = .830), error bars indicate 95% confidence intervals. All correlations are significant at p < .001 (see these data displayed in Figure 1).

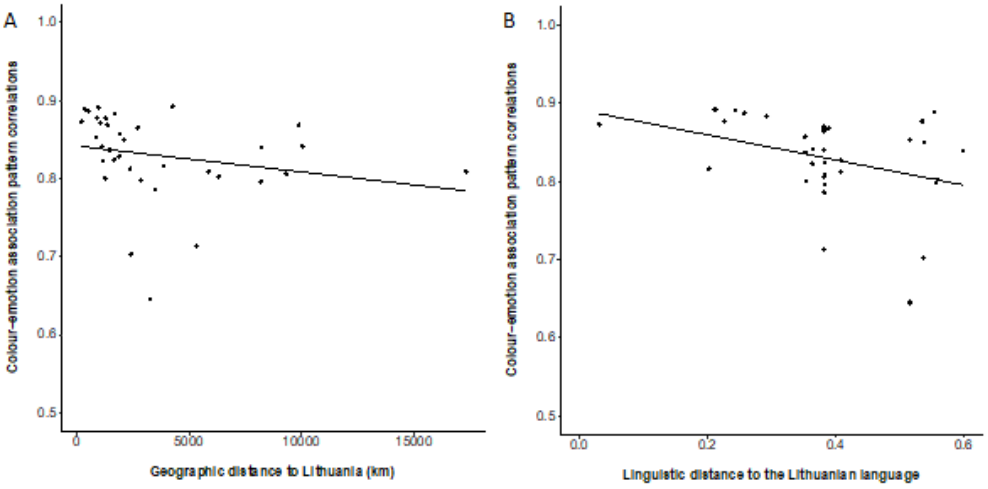
Linguistic and Geographic Distances

Lastly, we used two linear regression models to predict the degree of similarity of colour–emotion association patterns by geographic and linguistic distances from Lithuania/Lithuanian. The model with geographic distances as predictors was not significant,

$F(1, 34) = 1.81, p = .186, R^2adj = .023$, meaning that geographic distances could not predict colour–emotion pattern similarities between Lithuania and other nations. In contrast, the model with linguistic distances as predictors was significant, $F(1, 34) = 4.89$, $p = .034$, $R^2adj = .100$. Nations that spoke languages more closely related to Lithuanian also associated colours and emotion in a more similar way (Figure 5).

Figure 5

Similarity between the Lithuanian colour–emotion association pattern and the other nation, predicted by geographic distance (A) and linguistic distance (B)



Note. Only linguistic distance was a significant predictor.

Discussion

Colours carry emotional meanings to many (e.g., Adams & Osgood, 1973; Fugate & Franco, 2019; Jonauskaite et al., 2020), and Lithuanians were not an exception. Lithuanians had many colour–emotion associations, the most frequent being *red–love*, *yellow–amusement*, *yellow–joy*, and *black–sadness,* all endorsed by at least 60% of participants. These associations were many-to-many rather than one-to-one, indicating that one colour carried associations with several emotions and vice versa.

There were many similarities between the pattern of Lithuanian colour–emotion associations and that of the other 36 nations. Similarity to the global pattern (i.e., the pattern of all the remaining participants) was very high ($r = .92$). These results supported the universality of colour–emotion associations, also reported in previous empirical studies (Adams & Osgood, 1973; Johnson et al., 1986; Jonauskaite et al., 2020, 2023; Jonauskaite, Wicker, et al., 2019; Ou et al., 2018; Specker et al., 2018). When compared to each other nation individually, pattern similarities ranged between 0.65 and 0.89, being the most similar to Russian, Ukrainian, Estonian, Polish, and Italian patterns of association (see a detailed study of Russian colour–emotion associations in (Griber et al., 2019).

Such pattern similarities could be predicted by linguistic distance to Lithuanian, obtained from (Jäger, 2018). Nations speaking linguistically related languages displayed more similar colour–emotion association patterns than nations speaking more distant languages. Previously, linguistic similarity was not only important for general colour–emotion association patterns (Jonauskaite et al., 2020), but also for specific colours. For instance, English speakers were more likely to associate BLUE with *sadness* (Barchard et al., 2017), while German speakers linked *envy* to YELLOW (Hupka et al., 1997). This was perhaps because each language possesses metaphors linking these colours and emotions (i.e., *feeling blue* means to feel sad in English, and *Gelb vor Neid*, lit. to be yellow with envy, exists in German). In another study, emotion associations with the category PURPLE were predicted by the basic terms that participants used to label this category (Uusküla et al., 2023).

Curiously, pattern similarities were not successfully predicted by geographic distances to Lithuania. While geographic distance previously predicted the degree of *joyfulness* of yellow (Jonauskaite, Abdel-Khalek, et al., 2019), here the linguistic factors outweighed the geographic factors. While geographic and linguistic distances were correlated (i.e., participants living geographically closer also spoke more related languages), the two measures were not identical. Due to the past colonialisation, Indo-European languages are spoken well beyond the European continent. In the current sample, Mexican and Colombian participants spoke Spanish, while Nigerian and Filipino participants spoke English. The importance of linguistic distance suggested that colour–emotion associations might be encoded and transmitted through language. Indeed, even colour blind and blind individuals can associate colours with emotions (Jonauskaite et al., 2021; Sato & Inoue, 2016; Saysani et al., 2021), indicating that intact colour perception is not required to make such associations.

Beyond similarities, there were also some cultural differences. Lithuanians associated more emotions with colours than the others, suggesting that colours were particularly emotive to Lithuanians (also see Jonauskaite et al., 2020). Lithuanians also associated RED with *love* more strongly than *anger,* while participants in general endorsed both associations. In addition to the common associations (e.g., *sadness*), Lithuanians associated BLACK with *compassion* – a somewhat positive emotion concept in English (Scherer et al., 2013). This association could be explained linguistically, whereby *compassion* had been translated to Lithuanian as *užuojauta.* The latter word also means *condolences,* highlighting the link between *compassion/condolences* and *death*, and *death* is commonly represented by BLACK (Allan, 2009; Tham et al., 2020). Finally, based on the free responses, Lithuanians missed *calmness* as a potential response option, associating it with GREEN, TURQUOISE, BLUE, and WHITE.

The current study dealt with *associations* between colours and emotions. A priori, such research tells little about felt emotions. More studies, using different experimental designs, are necessary to understand whether colour can impact felt emotions, and if so, whether such impact goes in line with the conceptual colour–emotion associations (e.g., see Weijs et al., 2023; Wilms & Oberfeld, 2018). Likewise, the current study did not deal

with *colour preferences* (i.e., liking or disliking specific colours (Palmer & Schloss, 2010; Pranckevičienė et al., 2009; Stanikūnas et al., 2020)). Preferences are related yet distinct affective processes from emotion (Scherer, 2005). In other words, one cannot assume that emotion associations and preferences are always congruent (i.e., not all positive colours are liked, and vice versa). Perhaps, colour preferences are more personal than colour–emotion associations, reflecting aesthetic experiences rather than learnt abstract meanings of colour. More empirical research is necessary to disentangle the two types of affective connotations.

Conclusions

Across the globe, people associate colours and emotions (e.g., Adams & Osgood, 1973; Jonauskaite et al., 2020). Lithuanians too associated colour terms with diverse emotion concepts, most of which were similar to the other 36 studied nations, in particular, those speaking linguistically related languages. These observations demonstrate that colour can be used to communicate emotions effectively and universally, making it an important tool for applied sectors (e.g., marketing, design). As there were small cultural differences, emotion communication through colour could be further tailored for a specific country. For example, *red* represented *love* more strongly than *anger* for Lithuanians than globally, suggesting that Lithuanians considered this colour to be more positive. As the current study dealt with conceptual associations between colour terms and emotion concepts, future studies should test whether colours can also modulate experienced emotions. Such findings would be important theoretically (i.e., how abstract associations link to experiences) and practically (e.g., health sector, including chromotherapy).

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Appendix

Table A 1

Different emotions, not listed on the GEW, produced by the Lithuanian participants

Colour category	Colour term	Different emotion (Lithuanian)	Different emotion (English translation)	Count
RED	*raudona*	-	-	0
ORANGE	*oranžinė*	-	-	0
YELLOW	*geltona*	-	-	0
GREEN	*žalia*	ramybė	calmness	4
		ramumas	calmness	1
		nusiraminimas	relief	1
TURQUOISE	*žydra*	ramybė	calmness	3
BLUE	*mėlyna*	harmonija	harmony	1
		ilgesys	longing	2
		pasitikėjimas	trust	1
		ramybė	calmness	3
		šaltumas	coldness	1
PURPLE	*violetinė*	kūrybiškumas	creativity	1
		veržlumas	swiftness	1
PINK	*rožinė*	abejingumas	indifference	1
		drovumas	timidity	1
		moteriškumas	femininity	1
		naivumas	naivety	2
		švelnumas	softness	1
BROWN	*ruda*	globa	care	1
		maitinimas	feeding	1
		ramybė	calmness	2
		stabilumas	stability	1
WHITE	*balta*	harmonija	harmony	2
		monotonija	monotony	1
		neutralu	neutral	1
		ramybė	calmness	3
		taikingumas	peace	1
GREY	*pilka*	nuobodulys	boredom	3
BLACK	*juoda*	beviltiškumas	desperation	2
		desperacija	desperation	1
		ramybė	calmness	1
		uždarumas	closeness	1

Note. Count = the number of participants who gave an emotion. The majority of participants did not give any other emotions than those listed on the Geneva Emotion Wheel, thus, these counts are very low.