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Examination of Colour Emotions on a Sample of Slovenian Female Population

Proučevanje čustvenega odziva na barve na vzorcu ženske populacije Slovenije

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Abstract

Due to the complexity of colour perception and comprehension and its importance in contemporary life, there is an increasing need to understand the emotions which appear as our response to the observation of colour or coloured object. In the present research, the emotional response to colour was studied in a test group of Slovene female observers who were divided into four groups according to their age. The analysis was performed based on a questionnaire which included 21 colour samples of seven basic hues and different lightness and/or saturation. The observers were asked to arrange the colours according to five distinct pairs of characteristics: active-passive, like-dislike, warm-cold, stimulating-calm, modern-classical. The results showed that considerable differences exist regarding colour emotions, i.e. the emotional response to colour. The most pronounced contrasts between the women of different age were found with respect to the attribute pair like-dislike. In most cases women preferred colours that were recognized as active; these colours were mostly saturated and very intense. However, the ranking and selection of the most popular colours were different across age groups. In the group of female observers aged between 31 and 50 years, saturated colours were found to be less popular. The differences in the emotional experience were also observed with other attributes such as stimulating-calm and warm-cold. Regardless of the age, black was found to be a special case since it was described as a passive colour by the majority of women, in spite of being very popular.

Keywords: colour, colour emotion, female population, age effect, colour preferences

Izvleček

Zaradi kompleksnega dojetanja barv in pomembne vloge, ki jo ima barva v sodobnem življenju, v zadnjem času narašča potreba po razumevanju čustev opazovalca, ki nastajajo kot odziv na barvo oziroma obarvan izdelek. V raziskavi je bil proučevan čustveni odziv na barve v testni skupini žensk v Sloveniji, ki so bile glede na starost razporejene v štiri skupine. Analiza je bila izvedena na podlagi 21 barvnih vzorcev, ki so jih opazovalke ovrednotile s pomočjo vprašalnika. Vzorca so vključevali sedem osnovnih barvnih tonov in so se razlikovali v svetlosti in/ali nasičenosti barve. Naloga opazovalk je bila, da se do vsake barve opredelijo na podlagi petih različnih meril, ki so najpogosteje predmet raziskav: aktivna-pasivna, všeč mi je–ni mi všeč, topla–hladna, poživljajoča–umirjena, modna–klasična. Raziskava je pokazala, da s starostjo nastanejo razlike v opredelitvi do barve glede na njene karakteristike. Največje razlike nastanejo glede všečnosti barve. Opazovalke so kot najbolj priljubljene največkrat izbrale tiste barve, ki so jih doživljale kot aktivne. V večini primerov so to izrazite, nasičene barve, vendar se konkretna izbira najbolj priljubljenih barv po posameznih starostnih skupinah razlikuje. V skupini žensk med 31. in 50. letom so izrazite barve manj priljubljene. Do razlik v doživljanju barv prihaja tudi drugih karakteristikah, na primer pri oceni, katera barva učinkuje poživljajoče, prav tako pri odločitvi, katere barve so tople in katere hladne. Posebnost v vseh starostnih skupinah je črna barva, saj jo je večina žensk označila kot pasivno, kljub temu pa se na lestvicah priljubljenosti uvršča razmeroma visoko. Ključne besede: barva, čustveni odziv na barve, ženske, vpliv starosti, barvne preference

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1 Introduction

Formation of colour is a consequence of three factors, i.e. light source, coloured object and the observer who is influenced by psycho-physical characteristics, experiences, emotions, cultural influences and the environment [1]. Because of that, colours are perceived individually and colour can be defined as a subjective sensation which is generated in the brain triggered by the light entering the eyes of the observer [2].

Due to the complexity of colour perception and comprehension and its importance in everyday life, there is an increasing need to understand the emotions which appear as our response to the observed coloured object. Therefore, it is necessary to deal with the psychological aspect of colours. In Slovenia, dr. Anton Trstenjak is considered as being the founder of colour psychology. In his fundamental work, "Colour Psychology", he laid a foundation for a scientific experimental approach in psychology and studied several aspects of colours for example their reaction time, functional colour in working places, colour climate etc. He also investigated human affinity to colours in relation to fashion [3].

The projection value of a particular colour has been known for a long time as Tušak pointed out in his research. Every colour, even every shade, exhibits its own projection value. For example, dark blue expresses lasting values, navy blue means loyalty, trust and self-sufficiency, light blue is associated with longing, desire and homesickness. When studying a human response to colours, a problem arises as different authors often give the same names to colours that look differently [4].

Based on a systematic analysis of the responses of the observers in Great Britain and in China, a group of researchers have developed several colour models that make it possible to link the psychological response to a certain colour to its basic characteristics, i.e. hue, lightness and saturation, as well as to the CIELAB coordinates [5]. Another extensive study focused on an inter-cultural comparison of colour emotions and colour pairs [6]. Observers from eight different countries from all over the world took part in the study and it was found that only some of the colour characteristics, such as warm-cold, active-passive and heavy-light were perceived in a similar way, while significant differences were noticed regarding the like-dislike attribute.

Most of the studies in this field investigated colour samples with homogenous surfaces, but Lucassen et al. studied the effect of an object's surface on the perception of colour. The results showed that the perception of several characteristics, such as sharp-soft, heavy-light and warm-cold may be influenced by the surface texture [7].

Lately, the research of colour emotion, i.e. the emotional response to colour, has been focusing on particular groups of observers. One of the studies tried to explain whether the colour preferences and colour emotions change with age. The research was performed using single colours and colour pairs which were assessed for their harmony. Evident differences were found between a younger and an older group of observers considering the activity and the warmth of the colour as well as regarding the colour preferences [8].

To the best of our knowledge, no systematic analysis about the colour perception among women has been done in Slovenia so far. The purpose of our research was to investigate the emotional response to different colours on a sample of the female population of Slovenia and to examine whether the perception of colour changes with age.

2 Experimental

The emotional response to colour was studied on a test group of female observers in Slovenia. 21 colour samples were selected using HLS colour space [9], and containing seven basic hues: red (S1, S2, S3), yellow (S4, S5, S6), green (S7, S8, S9), blue (S10, S11, S12), violet (S13, S14, S15), brown (S16, S17, S18) and grey/black (S19, S20, S21) (Table 1).

Colour samples of size 15 × 15 cm were prepared using the CorelDraw X4 graphics software. Each colour was separately printed on a piece of a white cardboard using LaserJet Enterprise MFP (Hewlett Packard). Testing took place in an empty room with white walls. The illuminant was the noon sunlight with approximate colour temperature 5000 K. A grey background of size A2 was used to eliminate the influence of surrounding on colour perception.

40 female observers with normal colour vision took part in the study. As suggested by other authors, our observers were split into four groups according to their age [10]; each group consisted of ten observers:

1. girls up to 18 years
2. women 19 to 30 years

- 3. women 31 to 50 years
- 4. women 51 years or more.

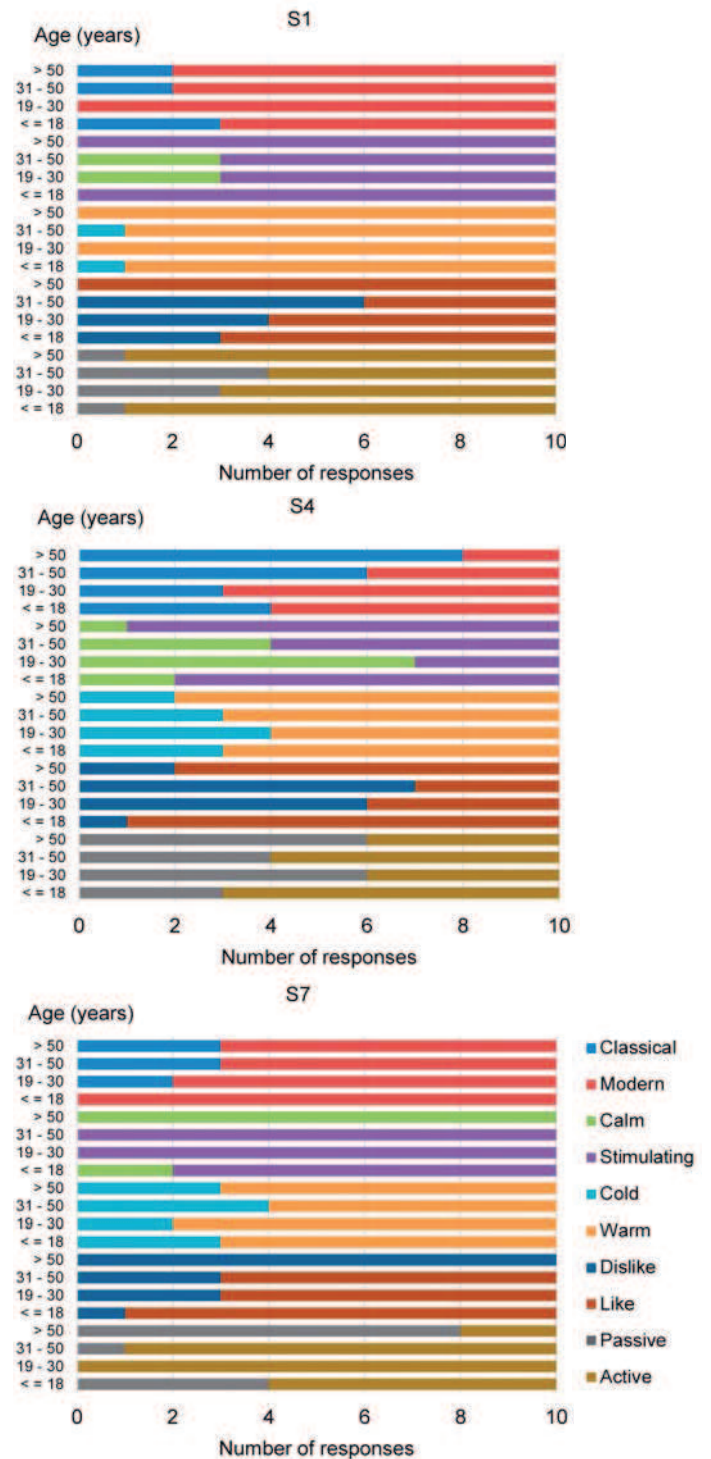
The investigation was performed through a questionnaire [11]. The observers were asked to make a decision regarding each of the presented colours in terms of five different attribute pairs frequently cited in the pertinent literature: active-passive, like-dislike, warm-cold, stimulating-calm and modern-classical [5, 6]. The observation of each colour sample took 2–3 minutes.

Table 1: Colour samples S1-S21 and their HLS values

Sample	Colour	H	L	S
S1	Red	0	50	100
S2	Light red	0	70	80
S3	Dark red	0	30	90
S4	Yellow	60	50	100
S5	Light yellow	60	70	80
S6	Olive green	60	30	90
S7	Light green	90	50	100
S8	Light lime green	90	70	80
S9	Dark green	90	30	90
S10	Blue	255	50	100
S11	Light blue	255	70	80
S12	Dark blue	255	30	90
S13	Magenta	310	50	100
S14	Light magenta	310	70	80
S15	Dark magenta	310	30	90
S16	Brown	30	40	50
S17	Orange	30	60	80
S18	Dark brown	30	20	30
S19	Black	0	0	0
S20	Dark grey	0	40	0
S21	Light grey	0	80	0

3 Results and discussion

The questionnaire results were first evaluated based on the assumption that the five pairs of colour characteristics can be regarded as opposite. Figure 1 shows the survey results for seven basic hues.



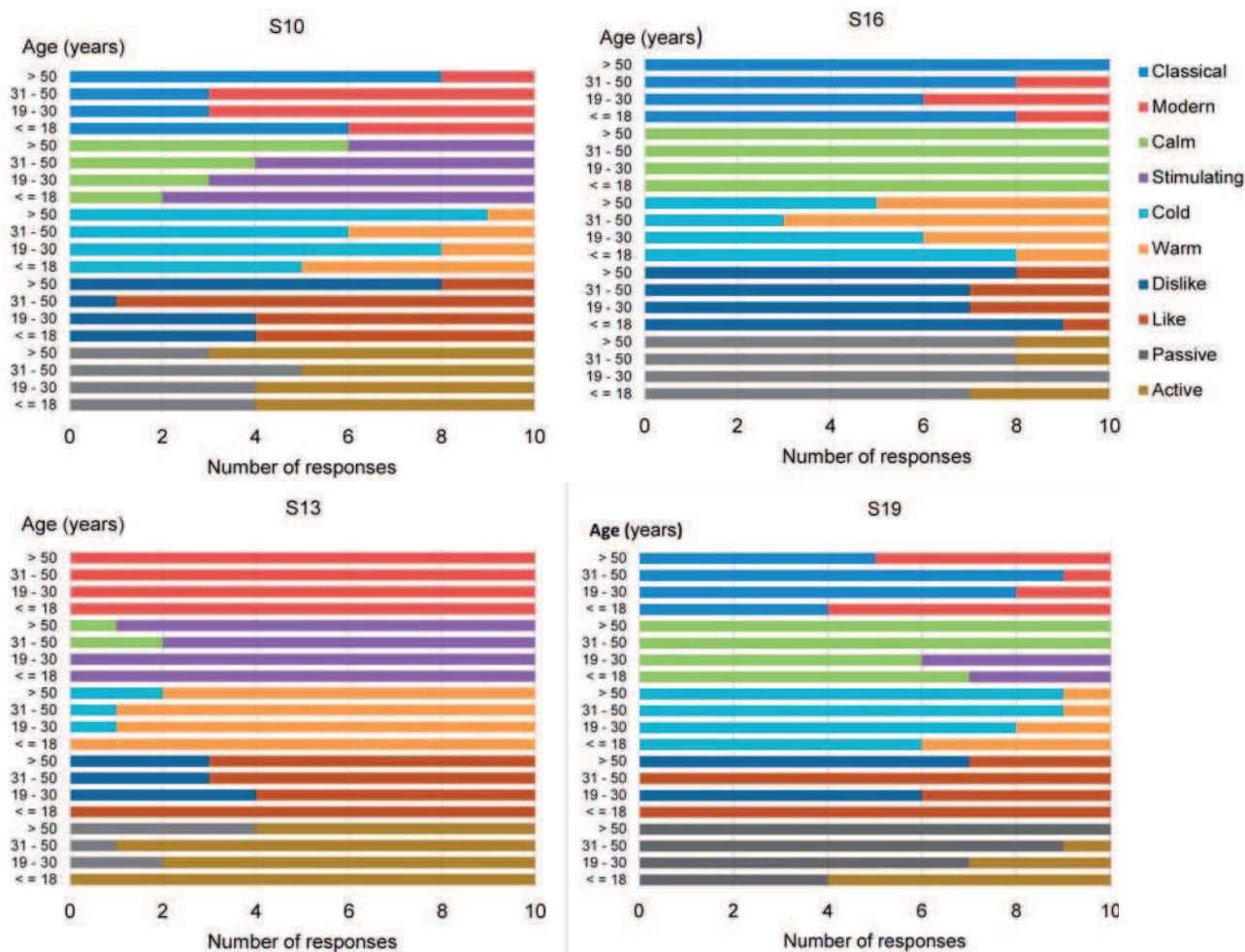


Figure 1: Number of responses for seven basic colour samples: red (S1), yellow (S4), green (S7), blue (S10), violet (S13), brown (S16) and black (S19)

According to Figure 1, all women have very similar opinion about S1. This colour is perceived as active, warm, stimulating and modern and these findings are in accordance with previous investigations [12]. This colour is very popular in the group of the oldest observers (women over 50), but much less with younger population (31–50 years). From Figure 1 we can conclude that S4 is a very popular and likeable colour among the youngest and the oldest observers. In both groups, this colour was also characterized as a very stimulating one. According to the opinion of the majority of observers, regardless of their age, S4 is a warm colour. The oldest observers also claim that this colour is classical. Blue colour is usually described as a very popular one among adults [4, 12]. In our study, this was only partly the case (Fig. 2). Colour sample S10 (saturated

bright blue) caused very diverse responses in different age groups. Only women between 31–50 like this colour, the oldest observers, on the other hand, evidently dislike it. We can assume that not only the hue but also other characteristics, such as the lightness and the saturation, affect popularity of a particular colour. Sample S7 represents a saturated bright green colour. The opinion of the observers younger than 50 years is that this colour is active and stimulating. In the group of the oldest observers, the responses were quite the opposite: S7 is regarded as passive, calm and very unpopular. More unanimous responses were provided for sample S13 as the majority of observers think that this colour is warm, active and stimulating, even though only the youngest observers distinctively like it. All 40 observers find this colour modern.


Sample S16 (darker brown with medium saturation) is a very calm colour according to the observers. Most of them also claim that this colour is classical, passive and they do not like it. Finally, black (S19) is perceived as cold, passive and calm. It is very popular in the group of teenagers and, interestingly, with women of age 31–50. In the second part of our study, we ranked all 21 colour samples according to the number of responses

given by the observers for each characteristic. Table 2 shows results for the attributes' pair like-dislike separately for each of the four age groups. The youngest observers (girls below 19) prefer violet shades and intensive, saturated colours as well as black. The least popular are brown and grey shades. Young women between 19 and 30 prefer blue colour (S12), but this sample is not identical to the one preferred by the youngest observers (S11). Women in

Table 2: Ranking of colour samples according to the attribute like-dislike for four age groups. Numbers represent the number of confirmative answers for the characteristic like.

Age group (years)							
Up to 18		19-30		31-50		Above 50	
Affirmative answers	Colour	Affirmative answers	Colour	Affirmative answers	Colour	Affirmative answers	Colour
10		9		10		10	
10		8		10		10	
10		7		10		10	
10		7		10		10	
10		7		9		10	
9		7		9		8	
9		7		8		7	
9		7		8		7	
9		6		8		7	
9		6		8		6	
7		6		7		4	
7		6		7		4	
6		5		7		3	
6		5		7		3	
6		5		6		2	
6		4		6		2	
5		4		6		2	
4		4		4		2	
3		3		3		1	
2		3		3		0	
1		2		2		0	

Table 3: Ranking of colour samples according to the attribute active-passive for four age groups. Numbers represent the number of confirmative answers for the characteristic active.


































































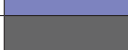






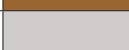

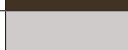
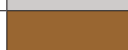
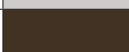

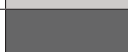





Age group (years)							
Up to 18		19-30		31-50		Above 50	
Affirmative answers	Colour	Affirmative answers	Colour	Affirmative answers	Colour	Affirmative answers	Colour
10		10		9		10	
10		8		9		9	
10		7		8		9	
9		7		8		8	
8		7		7		7	
7		6		6		7	
7		6		6		6	
6		6		6		4	
6		6		5		4	
6		6		5		4	
6		4		4		4	
5		4		4		3	
4		3		3		3	
4		3		2		2	
3		3		2		2	
3		3		2		2	
3		2		1		1	
2		2		1		1	
2		2		1		0	
1		2		1		0	
1		0		0		0	

this group also like green shades, but dislike black, brown and pale yellow. Women between 31 and 50 prefer intensive colours, such as different shades of blue (S11, S10) and also black. On the other hand, vivid yellow samples (S6, S4) are the least popular. Women over 50 prefer red and violet hues (S1, S3, S14, S15), but dislike darker colours (S7, S6, S18). Results for the characteristics' pair active-passive are given in Table 3. The youngest observers perceive

violet (S13, S14, S15) and bright blue (S11) samples as the most active. Interestingly, this group chose the same colours as the most popular ones. On the other hand, they describe darker hues of blue, green and brown (S9, S12, S17, S18) as the least active. Only in this group, black is described as a moderately active colour.

In the next group (young women aged 19–30), bright green colour of medium saturation (S7) is

Table 4: Ranking of colour samples according to the attribute modern-classical for four age groups. Numbers represent the number of confirmative answers for the characteristic modern.

Age group (years)							
Up to 18		19-30		31-50		Above 50	
Affirmative answers	Colour	Affirmative answers	Colour	Affirmative answers	Colour	Affirmative answers	Colour
10		10		10		10	
10		10		10		10	
10		9		9		10	
9		9		8		8	
8		8		8		8	
8		8		7		8	
7		7		7		7	
7		7		6		7	
7		7		6		5	
6		7		6		5	
6		6		4		5	
6		6		4		4	
4		5		4		4	
4		4		4		3	
4		4		4		3	
4		4		3		2	
4		3		2		2	
3		3		1		1	
2		2		0		1	
2		2		0		0	
0		1		0		0	

reported as the most active and actually all green samples, together with saturated violet and red (S13, S1), are perceived as active colours. Very similar results are obtained for the 31–50 years' group: saturated green and violet (S7, S13) are described as the most active colours. On the other hand, black, grey and darker brown or green are perceived as passive. In the over 50's group, two red samples of different lightness are reported as

the most active. Again, black and dark brown (S18) are seen as passive, together with, surprisingly, pale yellow (S5).

These results show that popularity or likeability of a certain colour very often positively correlates with its activity; this is especially evident in the youngest women's group. In most cases, intensive and saturated colours are seen as the active ones. However, black represents an exception since it is

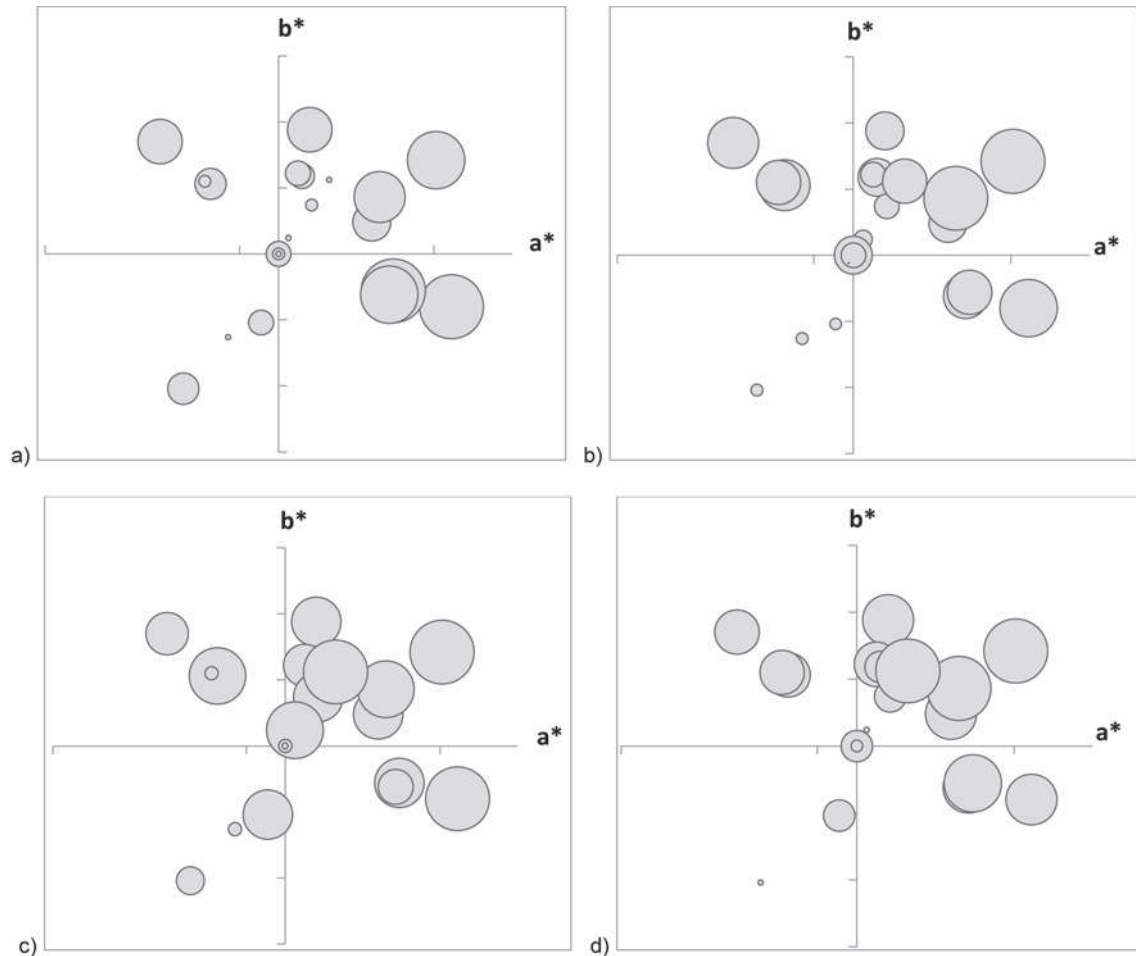


Figure 2: Number of confirmative responses to the question whether the colour is warm: a) girls up to 18 years b) women aged 19–30 years c) women aged 31–50 years d) women aged 51 years and more

quite popular in all age groups, despite the fact that it is perceived as being a passive colour.

Results for the attributes' pair modern-classical are displayed in Table 4. It is evident that women of different age perceive various colours as modern. However, they all agree that saturated violet (S13) represents a modern colour. Different shades of grey and brown, on the other hand, are perceived as classical. The opinion about black sample is not unanimous: only women aged 19–50 (groups 2 and 3) think that black is a classical colour.

Observers' responses to the two remaining characteristics' pairs – warm-cold and stimulating-calm – are displayed as bubble charts in a^*b^* plane of CIELAB colour space. Figure 2 visualizes the number of confirmative responses to the question whether the colour was perceived as warm; the size (area) of the circles corresponds to the number of confirmative responses.

The observers in general perceive all three shades of red as very warm. Certain differences between age groups exist, though, and such results confirm the findings of the previous investigations [8]. The youngest observers perceive violet samples (S13, S15) as the warmest but they do not find two brown samples (S17, S18) – which are perceived as warm by both groups 31–50 and above 50 – as warm. Smaller differences can also be noticed with green and blue samples: bright blue (S11) is considered fairly warm by the observers in the two older groups, but not by the women in the two younger groups.

Finally, Figure 3 shows the bubble charts in the a^*b^* plane of CIELAB colour space representing the number of confirmative responses to the question whether they find a particular colour stimulating. The youngest observers indicate as highly stimulating those colours that are positioned very

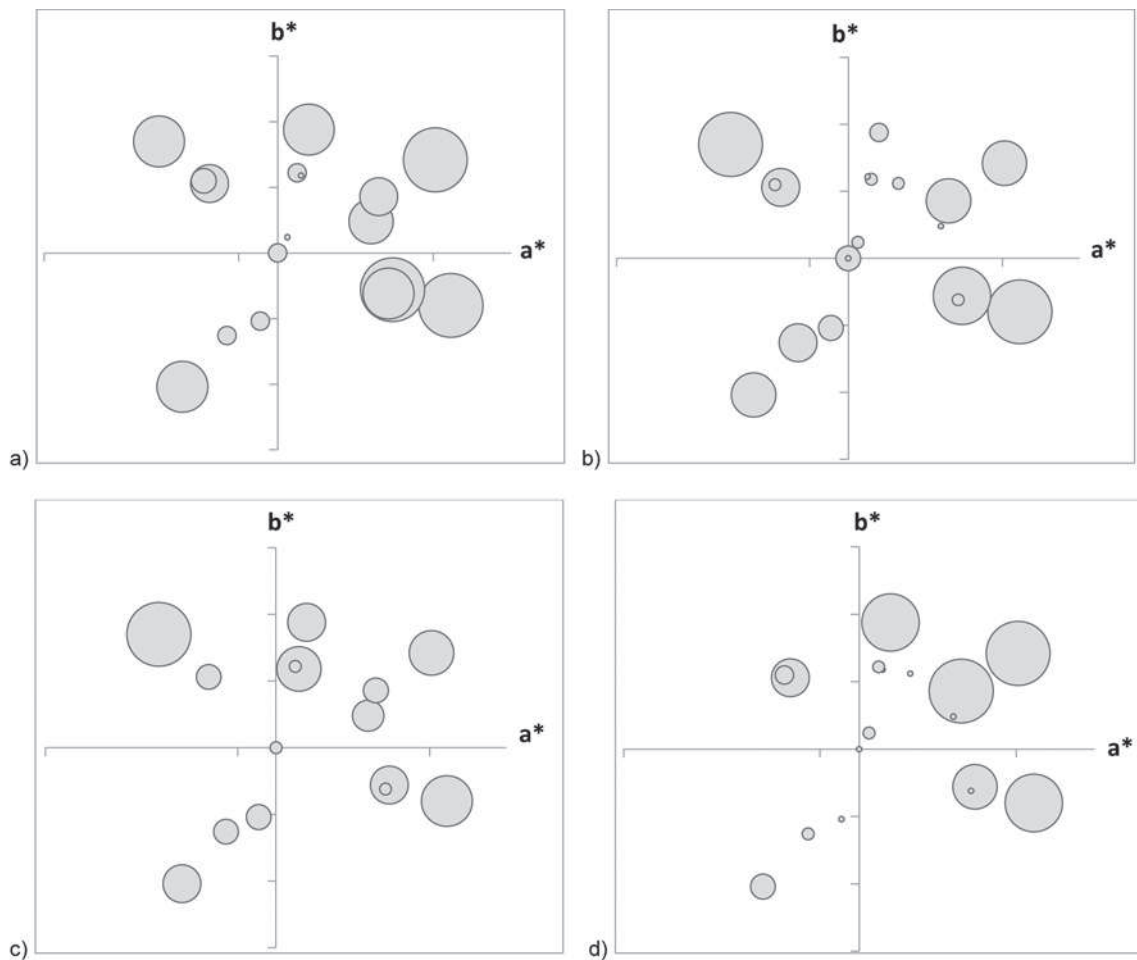


Figure 3: Number of confirmative responses to the question whether the colour is stimulating: a) girls up to 18 years b) women aged 19–30 years c) women aged 31–50 years d) women aged 51 years and more

far from the centre of the a^*b^* plane, i.e. very pure, saturated colours, mostly reds and violets. The preferences of women aged 19–30 and 31–50 are quite similar: they find one of the green shades (S7) as the most stimulating. The group of the oldest observers, however, perceive saturated red and violet shades as the most stimulating (Fig. 3d), which is similar to the responses of the youngest observers.

4 Conclusion

The emotional response to colour was studied on a test group of Slovene female observers who were divided into four groups according to their age. The most pronounced differences between the

women of different age can be found in relation to the attribute like-dislike. The youngest observers prefer pure, saturated colours, especially violets, but dislike neutral, unsaturated colours, such as grey and brown. In the group of female observers aged between 31 and 50 years, saturated colours were found to be less popular; these women prefer neutral colours.

Generally, women prefer active colours; these colours are mostly saturated and very intense. However, the ranking of the most popular colours is different for each age group. The differences in the emotional experience are also observed with other attributes of colour such as stimulating-calm and warm-cold. Black was found to be a special case since it was described as a passive colour by the majority of women, in spite of being very popular in all age groups.

References

1. JAVORŠEK, Dejana. Od CIE kolorimetrije do modelov barvnega zaznavanja. *Tekstilec*, 2012, **55**(3), 176–183.
2. GOLOB, Vera. *Barvna metrika*. Maribor : Univerza v Mariboru, Fakulteta za strojništvo, 2001, str. 3.
3. TRSTENJAK, Anton. Psihologija barv. Ljubljana : Inštitut Antona Trstenjaka, 1996.
4. TUŠAK, Maks. Psihologija barve. V *Interdisciplinarnost barve, 1. del : v znanosti*. Uredila S. Jeler in M. Kumar. Maribor : Društvo koloristov Slovenije, 2001, str. 87–118.
5. OU, Li-Chen, LUO, M. Ronnier, WOODCOCK, Andrée and WRIGHT, Angela. A study of colour emotion and colour preference. Part I: Colour emotions for single colours. *Color Research and Application*, 2004, **29**(3), 232–240.
6. OU, Li-Chen, LUO, M. Ronnier, SUN, Pei-Li, HU, Neng-Chung, CHEN, Hung-Shing, GUAN, Shing-Sheng, WOODCOCK, Andrée, CAIVANO, José Luis, HUERTAS, Rafael, TREMÉAU, Alain, BILLGER, Monica, IZADAN, Hossein and RICHTER, Klaus. A cross-cultural comparison of colour emotion for two-colour combinations. *Color Research and Application*, 2012, **37**(1), 23–43. doi:10.1002/col.20648.
7. LUCASSEN, Marcel P., GEVERS, Theo GIJSENIJ, Arjan. Texture affect colour emotion. *Color Research and Application*, 2011, **36**(6), 426–436. doi: 10.1002/col.20647
8. OU, Li-Chen, LUO, M. Ronnier, SUN, Pei-Li, HU, Neng-Chung and CHEN, Hung-Shing. Age effects on colour emotion, preference, and harmony. *Color Research and Application*, 2012, **37**(2), 92–105. doi:10.1002/col.20672.
9. Principles of color technology. Edited by R.S. Berns. New York : J. Wiley & Sons, 2002, str. 32.
10. DANGER, Eric Paxton. *The colour handbook : how to use colour in commerce and industry*. Aldershot : Gower Technical Press, 1987.
11. GUZELJ, Andreja. *Čustveni odziv na barve v ženski populaciji* : diplomsko delo. Ljubljana : Univerza v Ljubljani, 2014.
12. KOVAČEV, Asja Nina. *Govorica barv*. Ljubljana : Prešernova družba, Vrba, 1997, str. 113–139.