Coll. Antropol. 39 (2015) 3: 675–684
Original scientific paper

The Influence of Changes in Size and Proportion of Selected Facial Features (Eyes, Nose, Mouth) on Assessment of Similarity between Female Faces

Zdzisław Lewandowski

University School of Physical Education in Wrocław, Faculty of Physioterapy, Department of Cosmetology, Wrocław, Poland

ABSTRACT

The project aimed at finding the answers to the following two questions: to what extent does a change in size, height or width of the selected facial features influence the assessment of likeness between an original female composite portrait and a modified one? And how does the sex of the person who judges the images have an impact on the perception of likeness of facial features? The first stage of the project consisted of creating the image of the averaged female faces. Then the basic facial features like eyes, nose and mouth were cut out of the averaged face and each of these features was transformed in three ways: its size was changed by reduction or enlargement, its height was modified through reduction or enlargement of the above-mentioned features and its width was altered through widening or narrowing. In each out of six feature alternation methods, intensity of modification reached up to 20% of the original size with changes every 2%. The features altered in such a way were again stuck onto the original faces and retouched. The third stage consisted of the assessment, performed by the judges of both sexes, of the extent of likeness between the averaged composite portrait (without any changes) and the modified portraits. The results indicate that there are significant differences in the assessment of likeness of the portraits with some features modified to the original ones. The images with changes in the size and height of the nose received the lowest scores on the likeness scale, which indicates that these changes were perceived by the subjects as the most important. The photos with changes in the height of lip vermillion thickness (the lip height), lip width and the height and width of eye slit, in turn, received high scores of likeness, in spite of big changes, which signifies that these modifications were perceived as less important when compared to the other features investigated.

Key words: *face similarity, resemblance*

Introduction

The human face is a source of information on, among others, blood affinity, gender, age, emotional state and attractiveness of a given person[1–3]. The issue of facial similarity is most often raised in the context of choosing a partner, assessment of attractiveness, affinity[4] or computerized facial recognition systems[5] intensely developed in recent years.

Physical similarity plays an important role in human populations as it may indicate significant affinity, and in case of pairing of individuals, has both positive and negative consequences. On one hand, there is increased risk of the appearance of unfavourable mutations, one the other, there is increased reproductive success of a relative's genes[6]. Spuhler[7] and Hinsz's[8] research showed that partners in a relationship present a certain degree of similarity in terms of size of facial features, which may indicate a preference for faces similar to one's own. Subjects judging trustworthiness award higher marks to the images which had been artificially augmented to be similar to the subjects' faces[9]. Men who observe photographs of children modified so that they are similar to themselves more frequently declared a will to invest in them, in contrast to unmodified photographs[10]. In research conducted by DeBruine and partners[11] a strong preference was presented for similar faces, but only in the infertile phase of the cycle. People prefer tones of these elements possessed by the parent of their partner's gender[12]. In the context of parental investment, similarity plays an important role. Daly and Wilson[13] describe the high sensitivity in men to similarity to their children, and the readiness of mothers to assure them of such. Other research[14] may indicate the creation, from very early childhood, of facial »templates«,

Received for publication July 11, 2013

shaped by interaction with other individual in the given population, and which allow to distinguish between individuals within the population. The above research indicates that the ability to assess similarity plays a significant role in allowing to define level of affinity.

Another issue is the way in which our system of perception functions and assesses similarity between individuals on the basis of the face. Are the individual elements important? Or perhaps their location in relation to one another? Or maybe the shape of the face, or hair? There are a range of reports which describe the influence of various changes in facial morphology on correct identification or assessment of similarity. Some of these present a hierarchy of individual facial elements in the identification process[15–18]. Others[19–21] indicate that facial recognition processes are not based on identical cognitive processes. For example, a face completely turned „upside-down" will be perceived differently to faces in which individual elements have been turned around. Other authors claim that both of these processes are connected and it is difficult to consider them separately, as, for example, a change in one element may bring with it a change in configuration[22–23]. A fairly detailed hypothesis concerning face processing is described by Schwaninger et al.[24].

Facial similarity may also be considered the closeness of neighbouring points, as a reflection of observed actual images in a multi-dimensional visual space. The closer these points are to one another, the greater the similarity between the faces. Facial representation as a point in multi-dimensional space is associated with prototype faces i.e. those which remain in our memory as an average facial image, created from images of persons seen during one's life. The average face is theoretically found in the middle of multi-dimensional space; to which faces are referred and compared (this is synthetically described by Fifić[25]). In this way, based on the „distance" between particular points in this space, the brain is able to assess similarity between faces.

Perception of the face may also depend on the amount of information contained therein, which Phillip Schyns and Oliva Aude[26] well illustrated, describing how, depending on the distance from which we observe the face, our brains interpret the image on the basis of details or general information.

It is also possible to find research[27] concerning ways and methods of creating human composite sketches. It has been indicated that even professionals in this field cope to a varying degree with accurate composition of even very familiar faces. Research has shown that single composite sketches created by specialists show less similarity to the person sketched than sketches created by averaging single composite sketches[28–29]. There have also been experiments[30], which show that reducing photograph resolution so that only the outline of the face, hairline and shadows where there are facial elements are visible does not have a significant effect on identification of familiar persons, and that our perception system manages quite well with limited information.

The experiment conducted in this work was aimed at answering the question: how do we assess similarity with changes to defined elements in the female face, and what influence does the gender of the judge have? The research was carried out on composite faces with averaged values for facial features. This allows avoidance of additional factors (e.g. attractiveness, asymmetry) which could distort the results. Furthermore, the processing of typical schemas is achieved significantly more quickly than atypical[31], and their observation involves fewer neuron resources[32].

Material and Methods

The photographs used for the creation of the average female image were taken with a digital camera using an external photoflash lamp. For each person, the point of focus was halfway down the length of the face. All the subjects looked directly at the lens, did not smile and their hair was brushed back to uncover the hairline. These photos, of 30 students (aged 19–23) of the University School of Physical Education in Wrocław, were taken in 2006–07. Photographs in which the subject had his forehead covered, eyes closed or head in an asymmetric position were rejected. The photos were averaged in the Psychomorph programme (University of St Andrews). The final average woman portrait (Figure 1) was the result of averaging of more than 4600 points in 26 photographs.

The modification of each facial feature consisted of the following (Figure 2):

- change of size – enlarging (up to +20%, in 2% steps) and reducing (up to –20%, in 2% steps),
- change of width – widening (up to +20%, in 2% steps) and narrowing (up to –20%, in 2% steps),
- change of height – an increase in height (up to +20%, in 2% steps) and a decrease in height (up to –20%, in 2% steps),

Following modification, each element was placed on the original face and underwent retouching in Adobe Photoshop 7.0 CE to hide the placement marks for overlaying face fragments. The overlapping elements had special calibration points thanks to which it was possible to avoid relocation of the elements relative to their original position.

Through manipulation of the pictures, 180 portraits were achieved (3 features x 6 modification methods x 10 degrees of change intensification = 180 portraits). An example formed by gradual changes of width of lips of female subjects is shown below (Figure 3).

Due to the great number of photos (180 pcs. of the modified portraits), the material was divided into two equal groups of portraits, each of 90, called rounds »I« and »II«.

The research procedure was as follows:

- the subjects received uniform instructions on their participation in the study,
- prior to the study, the judges saw two original portraits and were informed that such resemblance be-

Fig.1. A female face formed as a result of averaging of 26 photographs by means of the Psychomorph programme (University of St Andrews).

tween the individuals indicated the maximum grade on the scale proposed (the judges' calibration),

– both portraits (the original one and the modified one) were displayed simultaneously on the computer screen,

– in each of the two windows of the programme, position of the portraits was generated at random for each exposure (so that the judges would not remember in which window the modified portraits were displayed, thus excluding potential influence of the position on visual perception),

– for each judge, portraits were presented at random (reducing the risk of comparative assessment of the particular portrait to the other ones and minimizing a possible change of the judge's assessment method during the examination and the effects of distraction, which may occur),

Fig.2. Female portraits with extremely modified facial features.

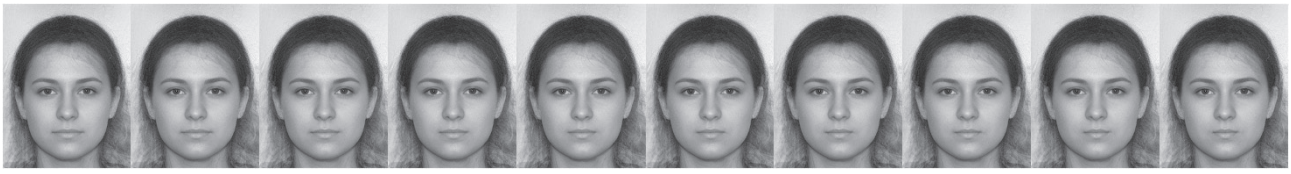

Fig.3. Sample series of portraits with changes of lips width (98-80%).

– the exposure time of the portrait pair was not limited,
– between the exposures of the particular portraits there was a break of 1000ms consisting of blanking the image,
– recording of results involved mouse-clicking on a special button on a scale under the images displayed,
– the scale of grades was visible and defined for the duration of the examination.

The above-mentioned conditions were ensured by a special software package called »Anthropologus« created by the author. Under the portraits displayed, there was a bar with the buttons (1–7) defined, which was displayed all the time, and the ends of the scale were defined as »very dissimilar« and »very similar«.

The judges were instructed as follows: Assess the similarity of the individuals observed on a seven-point scale where: 7 indicates that they are very similar, and 1- very dissimilar. All the subjects used the same notebook with a matt 14" LCD screen and a resolution of 1024x768. The distance from the computer was approx. 0.5–0.7m. There was scattered light in the room where the assessment was carried out.

Materials

83 women and 89 men, students of the University School of Physical Education in Wrocław, from all fields of study and between the ages of 18 – 40 years (women mean=20.2; SD=1.4; men mean=20.5; SD=2.4) acted as judges in the examination. For the assessment of similarity, 180 photographs of modified a female faces and a photo of one woman without any modifications were used. All portraits (180+1) were compared to the original photograph (without any changes). Each portrait was assessed from 41 to 46 times by women and men (the differences resulted from the division of the material examined and the size of the groups of judges). Each student observed a series of 91 pairs of portraits (I or II round).

Statistical methods

Due to the (similarity assessment) scale applied, median and quartile deviations $S_Q=(Q_3-Q_1)/2$ were used in the analysis. A reference point for the assessment of modified portraits and facial features was provided by the scores on the similarity scale awarded by the judges to the portrait without any changes (the original one). If the medians of the similarity assessment of the modified portraits were within the quartile deviation of the original image, the faces with those changes were considered most similar to the image without modifications. They were marked grey on the graphs. However, if the medians of the similarity assessment of the modified portraits were beyond the quartile deviation of the original image assessment, the photos were considered to be significantly less similar to the image without any changes. These portraits were marked on the graphs in black.

Non-parametric variance analysis, ANOVA, with Friedman and Kendall's consistency coefficient was applied for measurement of the differences between the scores awarded by people of different sex. Comparisons between the two groups were carried out i.e. a FoF group and a MoF group, where F stands for –female, M –male, and o – a judge). For post-hoc analysis, the pair sequence tests by Wilcoxon were applied, which compare the sequence of ranks for n=21, thus for all portraits of each series within the complete scope of modifications. Those dependencies were considered to be statistically significant $p<0.05$.

Results

It has been assumed that if the judges were not able to notice any differences, they assigned a high similarity grade. Where differences were noticed they assigned proportionally fewer points on the used scale. When we take a look at similarity grades assigned to particular portraits in the series (from 80% to 120%) we can see that lower grades appear faster in the presence of some changes than they do in relation to changes in other facial features. The term »faster« means: »together with« the increasing change and does not refer to time which is needed for portrait evaluation.

Median likeness assessment for individual protraits by judges of both sexes is presented in Table 1.

Eye slit modifications

Among all tested modes of eye slit modifications, the changes concerning its size were most quickly noticeable. The judges, along with increasing degree of modification, awarded lower scores on the similarity scale, resulting in a lower number of portraits in which medians of evaluations remain within the quartile deviation than in the case of other modifications of this feature. Within the tested groups (Figure 4), the modifications consisting of increasing of eye slit height did not make the judges award low marks on the similarity scale. Therefore, either these modifications were not perceived at all, or despite their existence, were not considered by the judges as significantly decreasing the impression of similarity. It is worth noticing that reduction of eye slit height was more quickly noticed by judges of both sexes than its enlargement. In comparison to other eye slit modifications, its width enlargement was probably more quickly perceived than its height enlargement, but more slowly than the enlargement of eye slit as a whole. It is proved by the marks given to the portraits by the judges on the similarity scale (Figure 4). Similarly to the case of eye slit height enlargement, men and women perceived more rapidly the narrowing than the widening of the modified feature (Table 1). In none of the tested cases were any significant differences between the marks given by the judges of both sexes within a given mode of modification statistically proved (Table 2)

TABLE 1
MEDIANS OF THE SCORES GIVEN TO THE PORTRAITS BY JUDGES OF BOTH SEXES

Feature	Change	Sex	Value of modification [%]																		
			80	82	84	86	88	90	92	94	96	98	102	104	106	108	110	112	114	116	118	120
			Median																			
Eyes/ Eyeslit	↔	M	3	4	4	4	4	5	5	6	5	6	6	6	6	6	6	5	5	5	5	5
		F	3	2	3	4	4	5	5	5	6	6	6	6	6	6	5,5	6	5	5	5	3,5
	↕	M	3	3	3	4	4	4	5	5	6	6	6	6	6	6	5	5	5	5	5	5
		F	3	3	3	4	4	4	4	5	6	6	6	6	6	6	6	5	5	5	5	5
	↕↔	M	2	2	2	4	3	4	4	5	5	6	6	5	6	5	5	5	4	4	3	4
		F	2	1	3	2	3	3	5	5	6	6	6	6	6	6	5	5	4	4	4	1
Nose	↔	M	3	4	4	4	4	4	5	5	6	6	6	6	5	5	5	4	4	3	3	3
		F	4	4	4	5	4	5	5	5	6	6	6	6	5	6	4	4	4	4	2,5	3
	↕	M	2	2	2	3	3	3	4	5	5	6	5	6	5	4	4	4	3	3	2	2
		F	1	2	2	3	2	3	4	4	5	5	6	5	6	5	4	3	2	3	2	2
	↕↔	M	1	2	2	3	2	3	4	4	6	5	5	5	4	4	3	3	2	2	2	1
		F	2	2	1	2	2	3	4	4	4,5	5	5	5	4,5	4	3	2	2	2	2	1
Lips/ Lip red	↔	M	3	4	4	4	5	5	5	5	6	6	5	6	5	5	5	4	4	4	4	3
		F	3	3	4	5	4	5	5	5	6	6	6	6	6	5,5	5	5	4,5	4	4	3
	↕	M	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	5	5	5
		F	4	4	5	5	5	5	6	5,5	6	6	6	6	6	6	6	5,5	6	6	6	5
	↕↔	M	3	3	4	4	4	5	5	6	6	5	6	5	6	5	5	4	4	3	3	3
		F	3	3	3	4	4	5	4	6	6	6	6	6	6	5	5	5	4	3	3	3

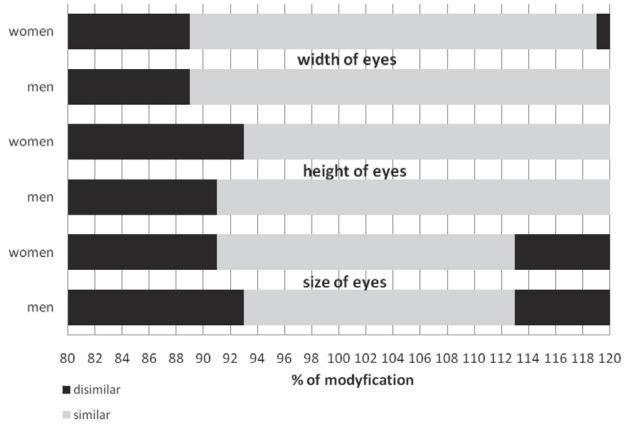

Fig. 4. Portraits with the eye slit modifications assessed by the judges of both sexes.

TABLE 2
WILCOXON TEST RESULTS FOR EYES, NOSE AND LIPS MODIFICATION

Feature /change	Eyes/Eyeslit		Nose		Lips/Lip red	
	p	Z	p	Z	p	Z
Size	0,799	0,255	0,208	1,258	0,686	0,405
Height	0,479	0,707	0,262	1,121	0,686	0,405
Width	0,237	1,183	0,151	1,437	0,327	0,980

Nose modifications

Nose size modifications were the most quickly perceived among all the tested features, which is proved by very low marks on the scale of similarity, awarded by the judges with even slight modifications of this feature (Figure 5). Women's portraits with nose sizes modified as slightly as 4–6% from original size were given very low marks on the scale of similarity and proved significantly less similar to the original portrait. The changes in the height of the nose were perceived by the judges very quickly in comparison to the other features and only slightly more slowly than the changes in the size of the nose (Figure 5). Low medians of the scores given by the judges on the Likert scale to the portraits with extremely big modifications point to the high significance of the modified feature in the process of perception. Among all three modes of nose modification, the changes in its width were noticed the least easily, or had the smallest significance in the perception of similarity (Table 1). The assessments

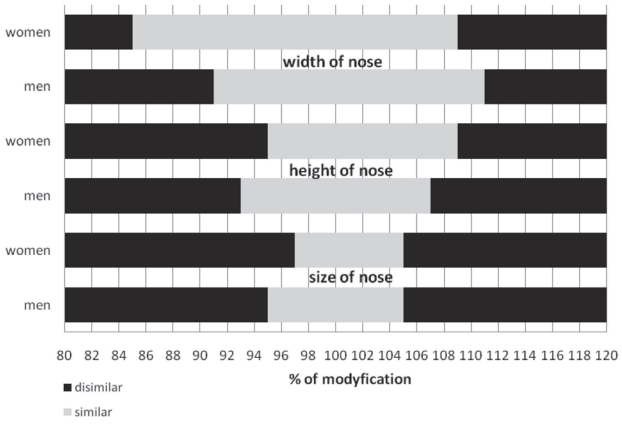

Fig.5. Portraits with the nose modifications assessed by the judges of both sexes.

of similarity given by women and men in did not turn out to be statistically significant in any way (Table 2).

Lip (lip vermillion) modifications

Changes in lip size in comparison to other modifications of this facial element were the most rapidly perceived, as the judges stated the smallest number of portraits as the most similar to the original portrait (Figure 6). Changes in the height of the lip vermillion turned out to be the modification which went unperceived by the judges over almost the whole range of modifications proposed, or else the judges did not deem this face modification as a factor significantly decreasing the impression of similarity. This is confirmed by very high medians of marks of the most modified portraits. The portraits where the height of lip vermillion was maximally changed, i.e. up to 120% of the original height, were assessed almost identically as the portraits with no modification of this feature (Figure 6). A similar effect was observed only in the case of portraits with magnified eye slit height. Moreover, the modifications of lip vermillion height to 84% of the original size also went unperceived by the judges, which places such a modified feature in last position among all features tested in the whole test as far as its importance in the assessment of similarity is concerned. Modifications in the width of lips were perceived by the assessing individuals more quickly than the changes in lip vermillion height but more slowly than modifications in the size of the lips, which is evidenced by the number of modified portraits assessed as the most similar to the original portrait (Figure 6, Table 1). Wilcoxon's matched pairs rank test showed that the differences in the similarity marks awarded by the judges of each of the sexes are not statistically significant (Table 2).

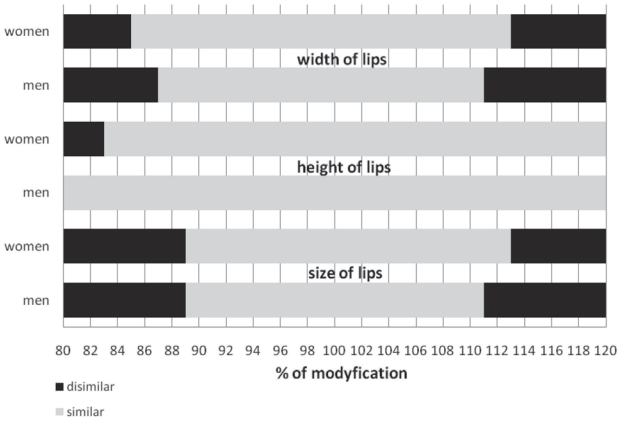

Fig. 6. Portraits with the lips modifications assessed by the judges of both sexes.

Feature significance pyramids and the scopes of safe modifications

As together with the growing modification values the judges relatively often awarded low marks on the scale of similarity, which means that the number of the modified portraits with the medians of assessments remaining within the quartile deviation is small. This in turn allows us to suppose that the tested individuals perceived quite rapidly changes in this feature and/or they were important for the impression of similarity. The number of the portraits assessed as similar defines the so-called »safe modifications range«, which gives extreme values of modifications of the features, within which the changes do not cause significant reduction in the marks awarded on the similarity scale.

The tested features are characterized by a large range of the above-described extremes (or limits of perceivable changes), which allows them to be arranged in a definite order. In this way schematic pyramids were built (Figure 7). At the top were placed the features whose changes are noticed relatively easily (quickly) and at the base those in which large modifications went unnoticed (or else influenced the assessment of similarity to a lesser degree). Feature significance pyramids (the ranking of features whose changes lower the degree of similarity) were separately made for the judges of each sex. The left side of the graph depicts the facial elements whose modifications consisted of their reduction, narrowing or shortening, whereas the right one contains the features which were enlarged, widened or lengthened. In the majority of the tested ways of modification it was observed that a smaller number of portraits were assessed as similar when both or any of the dimensions of the facial elements were reduced. Therefore, the judges perceived more easily the changes consisting of reduction, narrowing or shortening, as opposed to modifications consisting of enlargement, widening or heightening of the tested features. For this reason, in all the pyramids the facial elements were arranged in order of the number of the most similar portraits in which the modifications consisted of the reduction of a dimension of the tested features.

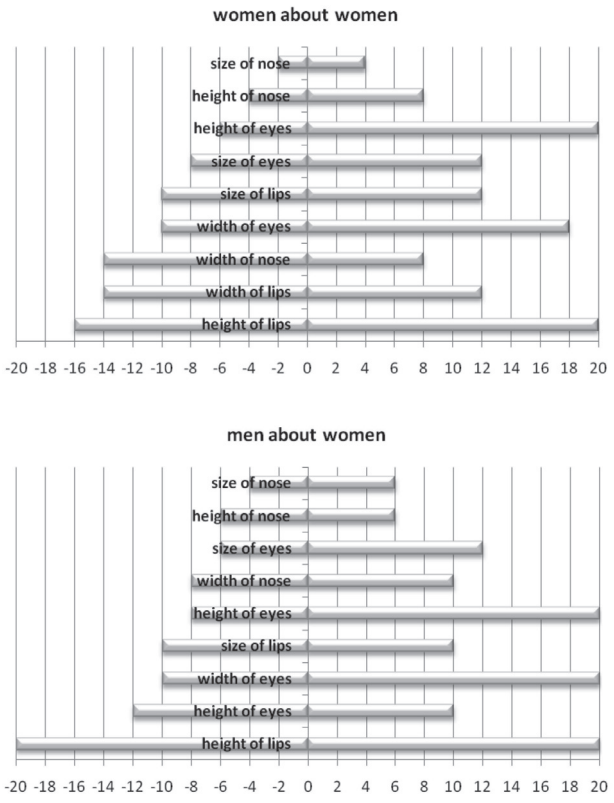

Fig.7. Feature significance pyramids for the judges of both sexes.

The order of features in both pyramids is similar. At the top (Figure 7) one can find modifications of the size and height of the nose which points to the considerable ease of perceiving changes in this facial element by both women and men. In further places appear modifications in the height and size of the eye slit. It is worth noticing that the reduction of the eye slit height was noticed relatively quickly, whereas the enlargement of its height went unperceived or else was considered by the judges as not influencing significantly the impression of similarity.

The least perceptible were the changes in lip vermillion height, its width and enlargement of the height and width of the eye slit. It is also possible that those features were perceived but despite changes in them did not lower the subjective impression of similarity, as was in the case of other tested features.

Discussion

Developing new possibilities in image transformation[33] allow the design of new areas of research concerning the human face[34] which have so far been impossible. In this paper the analysis proved the existence of features whose relatively small modifications are perceived by the tested and the presence of the changes in the faces of the portrayed people causes lower similarity marks to be awarded on the Likert scale than in the case of other features. Such a facial element is nose. Its changes (concerning height and size) are perceived as those that lower the degree of similarity the most, independently of the sex of the judges. Nose modifications are characterized by the narrowest scopes of modifications in which they are perceived as similar to the original, irrespective of their direction. Slightly lower marks for similarity were awarded by the judges when the nose was reduced or shortened than when it was enlarged or lengthened. In the test the faces are watched en face and on a flat monitor, which means that we are unable to observe the nose profile or its shape and still our brain notices very easily the changes in its size or height. In Lewandowski and Pisula's[35] the reduction of the nose size was singled out as the change influencing the image of the face most[36] pointing out that the nose profile is one of the features that significantly influence the proportions and the construction of a face. Why is this facial element so important? A possible reason may be the fact that a change in the size or the height of the nose gives two effects: a change in the facial element and a change in facial configuration. Each change in size and height of the nose influences its placement in relation to the other facial elements. In case of the modifications of other facial features, their location does not change as much as the location of the nose. This results from the fact that those modifications are done in such a way that their "centre" does not change; eg. in the case of lips, though they change their proportions or size, their location remains the same, because it is defined in relation to the stomion point. The point of reference for nose modifications was the nasion point. As it is not located in the middle of the nose height, the changes concerning the nose may be perceived in a different way than other modifications. Moreover, the nose is the facial element located in the middle of the face and may constitute the main point of reference for our perception system, as well as being this facial element which only slightly changes during changes of facial expression. The relative stability of this feature results in our perception system not being accustomed to its big dynamics, which in turn explains why already relatively small changes were easy to notice. Therefore, lower similarity marks were awarded to the portraits with modifications of the above-described element.

Among the tested features there are also those whose modifications do not cause a significant decrease of similarity, such as change in the lip vermillion height. Independently of the judges' sex, increasing the height of the lip vermillion by as much as 20% did not cause a significant decrease of similarity marks for the portraits with this change. In a similar way, the tested individuals reacted to a reduction in lip height. It may point to a relatively small role of this facial element in the assessment of similarity. In Danel's unpublished research, conducted on a group of almost 250 people, lip height is characterized by the largest variability coefficient among the tested features for men (22.1%) and the second largest (13.3%), following the lip coefficient (13.8%), for women. It is probable that our brain gets accustomed to such a large variability of a feature and becomes less sensitive to its changes. Moreover, the lips are a very dynamic element of our face

and they change along with facial expression and emotions. Lips are shaped by the most numerous muscles and their shape expresses one strictly defined emotion at a time[37]. This can additionally strengthen the effect of smaller sensitivity to the changes of this facial element. Women undergoing cosmetic procedures most often increase the size of their lips. It is therefore probable that the observer perception system is more accustomed to greater variation in this feature.In a similar way we can explain quite low sensitivity of the tested to changes in lip width. Likewise, changes in eye slit height and increased width only slightly influence a decrease in similarity marks. It is curious that, although the enlargement of this feature dimensions (even to the extreme of the tested scale) causes only slight fall in similarity, their reductions are noticed more rapidly. It is interesting that although the enlargement of the values of this feature (even to an extreme value on the scale) causes only a slight decrease in similarity marks, their reduction is more quickly noticed. A relatively small decrease in similarity marks for the portraits with eye slit height changes may be explained analogically to lip modifications. The eye slit height variability coefficient (12%) in Danel's research (unpublished) has the highest value after the lip vermillion height (20.2%) and the lip coefficient (20.4%) (variability coefficient was calculated simultaneously for both sexes).

A large natural variability of this element, together with the variability resulting from the changes in facial expression and the natural movement of eyelids, or blinking, makes our brain not treat this feature (and this way of modification) as critical in the perception of a face (similarity assessment). Eye slit height modifications can be observed daily (eyelid blinking) depending, for example, on the lighting, angle of viewing surrounding objects or emotions expressed. As a whole it makes eyes, together with lips, the most changeable elements of our faces, which can explain a diminished sensitivity to the changes in similarity marks between the assessed portraits.

This way of thinking does not explain equally well why the portraits with eye slit width modifications did not receive much lower similarity marks in relation to the original portraits. This feature is not as variable as the elements described above; moreover, the distance between the points defining eye slit width do not change along with the emotions expressed. Perhaps the reason for lower sensitivity to this change can be explained by more difficult perception of the exact location of anthropomorphic points (»en« and »ex«). The angle created by the edge of the lower eyelid with the edge of the upper eyelid in »ex« or »en« point is a sharp angle, which may make the exact perception of this place (the end of eye slit width) more difficult. Therefore, the changes in this feature can be considered less important (as far as similarity assessment is concerned) by our perception system. Moreover, narrowing or closing eyes causes the eyelids to get closer to each other, which additionally impedes precise assessment of the eye slit width. Similarly, some of the head positions may cause the upper eyelashes to cover the external edge of the eye slit which obstructs and sometimes even prevents observation of the »ex« point.

It cannot be excluded that the results obtained are not associated with modified surface area or its relationship to other facial elements. This mechanism may exist and have an indirect influence on the result, however that face and its elements cannot be considered solely as a set of geometric figures. Undoubtedly, changes in size of particular facial elements result in the greater surface change (and therefore may be potentially most visible) – however changes only in height or width, resulting in an identical change in surface, are judged differently by observers (e.g. nose height and width). Thus, where ranking features as such (nose, eyes, lips) may have a certain connection with their surface area, this is difficult to explain in case of modificaton method within one given feature or change in the opposite direction (e.g. enlargement vs reduction).

The remaining facial elements and the ways of their modification take intermediate places in the »ranking of facial elements modifying similarity«, rank between those that may be described as most and least important. Their order is different depending on the judges' sex and the number of portraits assessed as similar and is approximately the same in particular modifications. The importance of these features for similarity assessment should be defined as intermediate.

During the entire test a tendency was observed for the judges to give lower similarity marks more quickly when the modifications consisted of reduction, shortening and narrowing of the features, as opposed to their enlargement, lengthening or widening. This fact can be connected with attractiveness. More prominent lips or eyes may be considered as more attractive and because of this, despite changes, may not be assessed as features lowering the impression of similarity. Since the tested person does not know which of the observed portraits is original and which has been modified, he or she can think for example, that the portrait with enlarged lips is the original one (because this one seems more attractive to them) and the original is less attractive and therefore less similar. Consequently, the evaluation of similarity of the modified portrait can be too high, especially where it concerns the elements of the face which considerably influence attractiveness. It may be assumed that the evaluation of attractiveness and similarity, despite having a common field of mutual dependencies, in some aspects are independent of each other. They cannot be connected in an easy way. It is also probable that for all the tested features there exist the same subconsciously functioning mechanism, which allows to perceive and assess similarity in a different way depending on whether the change is positive or negative.

Conclusions

1. The changes in the elements of female faces influence the marks awarded for the similarity between the original and modified portraits:

– changes in nose size and height have the largest influence on the assessment of the perceived similarity (they decrease the impression of similarity most and they are the most rapidly noticed),
– changes in lip vermillion height, lip width and eye slit height and width influence the similarity assessment least (they lower the impression of similarity least and they are the least easily noticeable);
– reduction, narrowing or shortening the height causes a more rapid decrease in the similarity marks than enlargement, widening or heightening.

2. The ranking of the features causing a decrease in marks on the similarity scale is very much alike for the judges of both sexes. Women and men assess similarity depending on the growing modifications of women's faces in a very similar way.

Acknowledgements

I would like to thank the Perception Laboratory at University of St Andrews for great software – Psychomorph.

REFERENCES

1. DEBRUINE LM, JONES BC, LITTLE AC, PERRETT DI, Arch Sex Behav, 37 (2008) 64. – 2. KOŚCIŃSKI K, Anthropol Rev, 70 (2007) 45. – 3. HAMILTON WD, J Theor Biol, 7 (1964) 1. – 4. KONNER M, The Tangled Wing: Biological Contraints on the Human Spirit. (Henry Holt and Co, New York, 2002). – 5. FILIPOWICZ E, KWIECIEŃ J, KŁYS M, FILIPOWICZ B, Bio-Algorithms and Med-Systems, 1 (2005) 3. – 6. BITTLES AH, Clin Genet, 60 (2001) 89. – 7. SPUHLER JN, Eugen Q, 15 (1968) 128. – 8. HINSZ VB, J Soc Pers Relat, 6 (1989) 223. – 9. DEBRUINE LM, Proc R Soc Lond B Biol Sci, 269 (2002) 1307. – 10. PLATEK SM, BURCH RL, PANYAVIN IS, WASSERMAN BH, GALLUP GG, Evol Hum Behav 23 (2002) 159. – 11. DEBRUINE LM, JONES BC, PERRETT DI, Horm Behav, 47 (2005) 379. – 12. LITTLE AC, PENTON-VOAK IS, BURT DM, PERRETT DI, Evol Hum Behav 24 (2003) 43. – 13. DALY M, WILSON MI, Ethol Sociobiol, 3 (1982) 69. – 14. RUBENSTEIN AJ, KALAKANIS L, LANGOLIS JH, Dev Psychol, 35 (1999) 848. – 15. DAVIES G, ELLIS H, SHEPHERD J, Perception, 6 (1977) 263. – 16. FRASER IH, CRAIG GL, PARKER DM, Perception, 19 (1990) 661. – 17. SADR J, JARUDI I, SINHA P, Perception, 32 (2003) 285. – 18. HAIG ND, Perception, 15 (1986) 235. – 19. TANAKA JW, FARAH MJ, Q J Exp Psychol A, 46 (1993) 225. – 20. LEDER H, BRUCE V, Q J Exp Psychol A, 53 (2000) 513. – 21. FREIRE A, LEE K, J Exp Child Psychol, 80 (2001) 347. – 22. SERGENT J, J Exp Psychol Hum Percept Perform, 10 (1984) 554. – 23. LEDER H, BRUCE V, Q J Exp Psychol A, 51 (1998) 449. – 24. SCHWANINGER A, CARBON CC, LEDER H, Expert face processing: specialization and constraints. In: Schwarzer G, Leder H, (Eds.) The development of face processing. (Hogrefe and Huber Publishers, Cambridge, 2003). – 25. FIFIĆ M, Emerging holistic properties at face value: assessing characteristics of face perception. PhD Thesis, (Indiana University, Indiana, 1994). – 26. SCHYNS PG, OLIVA A, Cognition, 69 (1999) 243. – 27. PLEWS S, The influence of some factors affecting facial composite production and their application in practical policing. PhD Thesis. (University of Stirling, Stirling, 2006). – 28. WELLS GL, HASEL LE, Curr Dir Psychol Sci 16 (2007) 6. – 29. BRUCE V, NESS H, HANCOCK PJB, NEWMAN C, RARITY J, J Appl Psychol, 87 (2002) 894. – 30. SINHA P, BALAS B, OSTROVSKY Y, RUSSELL R, Proceedings of the IEEE, 94 (2006) 1948. – 31. WINKIELMAN P, HALBERSTADT J, FAZENDEIRO T, CATTY S, Psychol Sci 17 (2006) 799. – 32. REBER PJ, STARK CE, SQUIRE LR, Proc Natl Acad Sci U S A, 95 (1998) 747. – 33. TIDDEMAN D, PERRETT D, Visual Comput, 18 (2002) 218. – 34. Tiddeman D, Burt M, Perrett D, IEEE Comput Graph Appl, 21 (2001) 42. – 35. LEWANDOWSKI Z, PISULA-LEWANDOWSKA A, J Comp Hum Biol (Homo), 59 (2008) 253. – 36. KOZIEŁ T, DĘBIŃSKI Z, WYGNAROWSKI S, Problemy Kryminalistyki, 205 (1994) 10 – 37. FLEMING B, DOBBS D, Animacja cyfrowych twarzy (Helion, Gliwice, 2002).

Z. Lewandowski

Akademia Wychowania Fizycznego, Zakład Kosmetologii, Katedra Podstaw Fizjoterapii, Wydział Fizjoterapii, al. I.J. Paderewskiego 35, 51-612 Wrocław, Poland
e-mail: zdzislaw.lewandowski@awf.wroc.pl

UTJECAJ PROMJENA U VELIČINI I UDJELU ODABRANIH ZNAČAJKI LICA (OČI, NOS, USTA) U PROCJENI SLIČNOSTI IZMEĐU ŽENSKIH LICA

SAŽETAK

Ovaj projekt je uzeo za cilj pronalaženje odgovore na sljedeća dva pitanja: u kojoj mjeri se promjene u veličini, visini ili širini odabranih značajki lica utječu na procjenu sličnosti između izvornog ženskog kompozitnog portreta i modificiranog portreta? I kako spol osobe koja ocjenjuje slike utječe na percepciju obličja lica? Prva faza projekta sastojala se od izrade slike prosječnog ženskog lica. Tada su osnovne značajke kao što su oči, nos i usta lica izrezane iz prosječnog lica i svaki od tih značajki je promijenjen na tri načina: njegova veličina je promijenjena smanjenjem ili povećanjem, njegova visina je izmijenjena kroz smanjenje ili povećanje od gore navedenih obilježja i njegova širina je izmijenjena kroz proširenje ili sužavanje. U svakoj od šest metoda alternacije značajki, intenzitet modifikacije dosegao do 20% izvorne veličine s promjenama svakih 2%. Značajke su promijenjene na takav način su ponovno zalijepljena na na izvorna lica i retuširana. Treća faza sastojala se od procjene u opsegu sličnosti između prosječno kompozitne portret (bez ikakvih promjena) i modificiranih portreta, koje su obavljali suci oba spola. Rezultati pokazuju da postoje značajne razlike u procjeni obličja

portreta s modificiranim značajkama od onih izvornih. Slike s promjenama u veličini i visini nosa su dobile najniže ocjene na skali oblija, što ukazuje da su ove promjene percipirane od strane ispitanika kao najvažnije. Fotografije s promjenama u visini debljine usne (visina usne), širina usana i visine i širine duplje oka su dobila visoke ocjene sličnosti, unatoč velikim promjenama, što znači da su ove izmjene percipirane kao manje važne u usporedbi s drugim istraživanim značajkama.