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ORIGINALNI ČLANAK 2022. Fakultet za sport i psihologiju Tims, Novi Sad  
TIMS Acta 16, 79–86

# UNIVERSALITY OF FACIAL EXPRESSIONS: AN INTERPLAY BETWEEN BIOLOGY AND CULTURE

UNIVERZALNOST FACIJALNIH EKSPRESIJA:  
INTERAKCIJA BIOLOGIJE I KULTURE

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## Abstract

The majority of people almost effortlessly read emotions based on the facial expressions of other people. Numerous studies suggest that even newborns are showing interest in faces and facial expressions suggesting that this ability might be relevant from the evolutionary standpoint. This is additionally supported by cross-cultural studies that clearly demonstrate the existence of a limited number of basic emotions which are universal. Furthermore, the influence of culture and the living environment is evident regarding emotional display and recognition accuracy. From a developmental standpoint, available data suggest that the development of facial expressions recognition could be described by an inverted U curve. Starting from childhood through adulthood, we are developing the same sort of expertise in facial expression recognition. Later, with aging, the recognition of particular expressions is declining. The exact underlying mechanisms that play a role here are not fully grasped yet. In this review, we shortly summarized previous studies that investigated the universality of facial expressions and cultural effects on facial expressions recognition. Furthermore, the potential developmental courses were explained and some of the open questions were outlined regarding this topic

## Keywords:

Facial expressions,  
Basic emotions, De-  
velopment

## Sažetak

Većina ljudi bez ikakvog napora može da prepozna emocije na osnovu facijalne ekspresije drugih ljudi. Brojne studije tvrde da novorođenčad pokazuju interesovanje za lica i facijanu ekspresiju i zbog toga se smatra da je ova sposobnost važna sa evolutivnog stanovišta. Ovo je dodatno podržano kroskulturnim studijama koje jasno ukazuju na postojanje ograničenog broja univerzalnih osnovnih emocija. Takođe, uticaj kulture i životne sredine je velik kada je u pitanju pokazivanje emocija, ali i tačnost njihovog prepoznavanja. U kontekstu razvoja, dostupne informacije pokazuju da se razvoj prepoznavanja facijane ekspresije može okarakterisati u obliku obrnutog slova U. Polazeći od detinjstva, pa kroz odraslo doba, ljudi razvijaju sposobnost za prepoznavanje facijalnih ekspresija. Kasnije, sa starenjem, prepoznavanje određenih facijalnih izraza se smanjuje. Ključni mehanizimi u ovom procesu nisu u potpunosti istraženi. U ovom preglednom radu, ukratko smo predstavili prethodne studije koje su istraživale univerzalnost

**Ključne reči:**  
facijalna ekspresija,  
osnovne emocije,  
razvoj

facijalnih ekspresija, kao i uticaj kulture na njihovo prepoznavanje. Takođe, objašnjeni su i potencijalni razvojni stadijumi i spomenuta neka od otvorenih pitanja vezanih za ovu temu.

## Introduction

Faces are an important source of information about a person's identity, gender, age, and current emotional state.

The facial expression of emotions plays an important role in social interaction because, not only do we want to anticipate other people's reactions, but we also want to allow others to have an insight into how we feel (Frith, 2009). Furthermore, facial expressions of emotions also play an important role in the aesthetic judgments of faces (Barzut & Blanuša, 2021) which is important in the context of sexual attraction and relationships.

The first ideas about the evolutionary significance of facial expressions can be found in the work of Darwin (Darwin 1872/1998 cited in Matsumoto et al, 2008), who considered facial expressions to be a residual of a more complex behavioral response. Darwin believed that all people, regardless of their culture, similarly express emotions as a result of evolutionary heritage. Furthermore, not only humans but also other primates, similarly display emotions. The basic idea is that the facial expression system was created for better adaptation. Some authors (Matsumoto et al., 2008) assume 5 key characteristics of facial expressions of emotion:

1. They occur universally in arousing situations
2. They are assessed in a universal way
3. They have an important social role
4. They are connected with a specific subjective experience
5. They are a part of a coherent system of emotional response

### Facial expressions between biology and culture

A study conducted in 1969 (Ekman & Friesen, 1969) showed that there are certain basic emotions for which facial expression is universal. These basic emotions include happiness, fear, disgust, surprise, sadness, and anger. These authors examined whether members of different cultures would name the facial expressions in the same way. The study included adult respondents from Brazil, the United States, Argentina, Chile, and Japan, as well as members of two tribes from Borneo and New Guinea. The main criticism came from the fact that all respondents were, to some extent, exposed to the same or similar media (even these two tribes had contact with Western culture). Therefore, the consistency in their responses might indicate learned patterns of facial activities which are culturally imposed, and do not represent the universality of emotions and facial expressions. Nevertheless, the next study (Ekman & Friesen, 1971) showed that even those tribes that have minimal contact with Western culture named facial

expressions of emotions in the same way as people living in developed countries of Western culture. The main advantage of this study lies in the fact that both children and adults were included in the study, and both groups of participants showed the same pattern of responses that is consistent with the responses of participants from other cultures. Interestingly, it is important to point out that adults had difficulty distinguishing fear from surprise. The same results were also obtained in a recent study with psychology students conducted in Serbia (Barzut, 2018).

Ekman (1992), in his later work, claimed that there are consistent findings for universal facial expressions for at least 5 basic emotions. The number of basic emotions may be even higher by three or four more emotions. For example, a study conducted by Ekman and Friesen (Ekman & Friesen, 1986) showed the universality of the facial expression of contempt. This study included respondents from Estonia, the Soviet Union, Germany, Greece, Japan, Italy, Scotland, Turkey, the United States, and West Sumatra. The cross-cultural agreement was as high as in previous studies done with other emotions. However, it is important to note that most of the countries included in this study belong to Western culture, so the influence of culture and common visual input cannot be completely ruled out. Additionally, the limitation of this study is the fact that all respondents were students.

In addition to cross-cultural studies, research with congenitally blind people also supports the biological basis of facial expression. Matsumoto and Willingham (2009) compared the spontaneous expression of emotions between blind and sighted athletes. The results of this study show that there is no difference in facial expressions. This result indicates that at least some forms of emotional expression are innate. Consistent with previous findings is a study conducted by Ortega (Ortega et al., 1983) that showed no differences in spontaneous facial expression between children with regular vision and children with congenital blindness. However, this study showed that differences in voluntary facial expressions still exist. Children who were blind from birth had significantly poorer voluntary facial expressions.

Contrary to the previously mentioned results, some studies provide arguments that facial expressions are not necessarily universal. Thus, Russell (1994) criticizes the methods used in cross-cultural research, which could have influenced the obtained results. Russell points out that these studies most often used the task of forced choice, pre-selected photographs of emotions that posed facial expressions of emotions. Furthermore, some studies

(Elfenbein & Ambady, 2002; Dailey et al., 2010) have shown that we are more successful in recognizing the emotions of people from our group, which additionally supports the idea that there are certain cultural specificities.

Even studies that suggest universal facial expression also report some cultural differences regarding the correct identification of emotions. For example, some studies (e.g. Ekman & Friesen, 1969) showed that even recognition of facial expressions of happiness in some parts of the world is not as accurate as in Western countries. Namely, the accuracy was 97% in Switzerland, Brazil and the United States, while it was only 68% in Africa.

Culture may play an important role in defining which emotions are acceptable to display. That would also indirectly affect the recognition accuracy of facial expressions. If showing some expression is not desirable (e.g. anger or sadness), we might not develop expertise in recognizing them. Furthermore, living in a culture that does not encourage discussion about emotions may result in poor labeling of emotions or problems to differentiate various emotions. Matsumoto (1992) reported the differences between American and Japanese participants regarding their ability to correctly identify expressions. Japanese participants had lower ratings for so-called negative emotions such as anger (64.20% vs 89.58%), disgust (74.72% vs 91.07%), fear (54.55% vs 81.85%) and sadness (71.88% vs 92.56%). However, the author claimed that even if differences occurred, the results still confirm the universality of facial expressions. In another study, Matsumoto (Matsumoto & Assar, 1992) investigated the role of language in facial expressions recognition. Bilingual participants (English and Hindi) judged facial expressions in two separate sessions, each conducted only in one language. The results showed that participants recognized fear, sadness and anger more accurately in sessions conducted entirely in English. Finally, there are also studies that show that culture also plays a role in the suppression of particular emotions. Friesen (1972 cited in Matsumoto, 2006) compared contentious facial expressions of American and Japanese participants in 2 situations: watching a highly stressful film alone or in the presence of an experimenter. While they were watching the film alone, their facial expressions of disgust, sadness, fear, and anger were similar. However, when the experimenter was present, the Japanese tended to suppress displays of negative emotions and instead they were smiling more. All these studies clearly support the idea that culture, language, and social norms affect perception. Certain culture defines which behavior is acceptable and which emotional displays are allowed in public (therefore display of anger and even sadness might not be encouraged). As the result, the average member of such a community might have less opportunity to learn to recognize these facial expressions on other faces. Additionally, knowing that displaying particular emotions is not culturally acceptable might be another confounding factor that negatively impacts the recognition of facial expressions.

The environment, or living conditions in which we grow up, can also affect our ability to recognize facial expressions. For example, Smith and Walden (1998) in their study examined the development of facial expression recognition of emotions in preschool children. Children who came from unfavorable backgrounds were more successful in recognizing the facial expression of fear. The authors of this study believe that these children are exposed to greater stress in their environment and that recognizing the expression of fear is particularly relevant and therefore improved. The results of this study highlight the importance of experience and learning for recognizing a particular emotion. Consistently, another study showed that abused children show a tendency to pay more attention to the facial expression of anger (Pollak & Kistler, 2002) which is (probably) more relevant in their environment, while those children did not differ from the control group in the ability to recognize other emotions.

The question of whether facial expressions are universal or culturally specific became even more complex in the context of gender differences. For example, some studies showed that women are more successful in recognizing facial expressions compared to men (e.g., Hall & Matsumoto, 2004; Rahman et al., 2004). Some of the explanations are that women are more successful in recognizing facial expressions of emotions because, in most cultures, women provide primary care. Therefore, it is necessary to adequately respond to the needs of children, especially toddlers, whose language is not yet developed. Additionally, the traditional understanding is that women strive for cooperation, which is why the ability to recognize the emotions of others is crucial. An additional argument for cultural effects on the display of emotions comes from another study (Barzut & Blanuša, 2021), where it was shown that sadness greatly affected the aesthetic judgment of male faces compared to female faces which is consistent with the common stereotype that "real men do not cry". Finally, some studies (e.g. Matsumoto & Assar, 1992) suggest an interaction between language and the perceived intensity of emotions. Bilingual participants rated the higher intensity of anger on female faces when the session was conducted in Hindi, while the higher intensity of sadness was attributed to female faces when the session was conducted in English.

From childhood to adulthood: how do the facial expressions of emotions develop?

There are no longitudinal and systematic studies that have tackled the development of facial expression recognition. Most of the studies focus on a certain age and current development. Consequently, the obtained results are usually not explicitly explained in some broader theoretical perspectives. Due to the technical limitations of experiments with younger children, it is very difficult to compare the results obtained at different ages. Namely, when conducting experiments with babies or toddlers, whose language is still not sufficiently developed, habituation

techniques and viewing preferences are typically used. On the other hand, different experimental tasks are used with older children as well as adults (e.g. forced selection task, old-new task, etc.). Thus, there is at least a minimal possibility that some differences that appear at different ages (or even the same age) could be a consequence of the experimental task used in particular research. An additional problem is that simpler techniques, used in research with babies and young children, usually give less information about the examined phenomenon, so the failure to detect some behavior does not necessarily mean that this function is not developed yet.

Some studies (e.g. Reissland et al., 2011) report that starting from the second trimester, instead of isolated activity of individual muscles, the movements of the facial muscles of a fetus become more complex. The authors use the term "gestalt" to indicate a particular muscle configuration that does not necessarily denote a particular emotion. In the period from the thirty-fourth to the thirty-fifth week of pregnancy, it is possible to distinguish between different facial gestalt, primarily the facial expressions typical for crying and smiling. The authors of this study (Reissland et al., 2011) believe that such findings indicate that emotions are present at birth or even before birth. However, a serious drawback is the fact that the participants were only two fetuses making it difficult to generalize this data.

Studies with newborn babies show that babies can distinguish between individual emotions at an early age. Farroni and colleagues (Farroni et al., 2007) showed that newborn babies (older than 24 h) show a preference for facial expressions of happiness over expressions of fear while they did not show preference nor the ability to distinguish between neutral facial expression and the expression of fear. Furthermore, 3-months old babies can distinguish between surprise and happiness and sometimes manage to distinguish between surprise and sadness (Yoirng-Browne et al., 1977). Research conducted by Serrano, Iglesias and Loeches (1992) with 4 and 6 months old babies has shown that these children can distinguish between anger, fear, and surprise. In addition, babies observed faces expressing anger longer than faces with facial expressions of fear. However, some authors (for details see Batty & Taylor, 2006) believe that although babies show an interest in faces at an early age and themselves display facial expressions typical for particular emotions, these actions are most often the result of reflexes and imitation and do not represent a true emotional response. Only at the age of 7-8 months, babies become able to recognize emotions, and even then, not all of them.

The facial expression of emotions is not the only way to express and describe emotional states and feelings. Language is a far more successful tool than facial expression itself. However, at a younger age, while language is not fully developed, facial expression plays a crucial role in the expression of emotions (Markham & Adams, 1992; Widen & Russell, 2008). Later, although verbal expression be-

comes dominant, facial expression still provides important support for verbal expression. It is often important to react quickly and accurately, and in these cases, our assessment is based primarily on the facial expression of emotions and not necessarily on verbal expression. Also, the mismatch of facial expression with body posture, voice, or content of the verbal message indicates that someone may be dishonest, which is relevant information.

Researchers in the field of facial emotion expression suggest that visible progress in recognizing facial emotion expression occurs at the age of 3 (along with the significant progress in speech), and this ability increases with age, to reach its peak at the age of 10 a level of performance appropriate for adults (Batty & Taylor, 2006; Markham & Adams, 1992). On the other hand, some studies (e.g. Vicari et al., 2000) point out that at the age of 10 children do not fully master the recognition of facial expressions of emotions and this is especially the case for emotions of fear and anger.

The results of this study confirm the continuous development and this was especially the case for the emotions of sadness, fear, and anger. However, it is important to point out that emotional recognition of happiness and sadness is very high at all ages, which is why the additive effect may not be visible. Similar to the recognition task, when respondents were asked to name a particular emotion based on a specific facial expression, they showed different performances depending on age and specific emotion. For the emotions of happiness and sadness, the participants were very successful at all ages, while for other emotions, the success increased with age. The naming of facial expressions of disgust is relatively low in all age groups and at the age of 10, the success rate is only 70%. Another study (Lawrence et al., 2005 according to Matsu-moto et al., 2008) conducted with children aged 6 to 16 shows an improvement in the ability to recognize emotions with age. In particular, the success of recognizing the emotions of happiness, surprise, fear, and disgust increases linearly with age, while the success of recognizing the facial expression of sadness and anger is constant.

Finally, it is interesting to mention the research conducted by Thomas and colleagues (Thomas et al., 2007). The authors of this study compared three groups of subjects, children (ages 7 to 13), adolescents (14–18 years), and adults (25–57 years) in order to detect and describe the late stage of development of facial expressions recognition. Three morphs of facial expressions of emotion were used in the study, namely: (1) from neutral facial expression to fear, (2) from neutral to anger expression, and (3) from fear to anger. The results of this study showed that adult subjects were more sensitive to minor differences in facial expression while there were no differences between children and adolescents. Further analysis showed differences in the development of recognizing the emotion of fear and anger. Namely, recognizing the emotion of fear as well as the transformation of fear into anger shows a

linear trend of development with age, while recognizing the facial expression of the emotion of anger shows a sharp increase in success between adolescence and adulthood. In addition, it has been shown that children had longer reaction times compared to adolescents and adults.

Thus, although developmental research on facial emotion recognition is not systematic and does not always yield consistent findings some regularities could be mentioned. Although it is still unclear whether facial expression of emotions is present before birth, the fact is that it is possible to measure facial muscle activity and observe some patterns that are parallel to the facial expressions of certain emotions at a later age. It is reasonable to assume that this muscle activity of the fetus is not accidental and that it probably has some important function (although we still do not know specifically what it is). The main problem with studies with babies is that different researchers detect certain behaviors at different ages. Some experimental procedures appear to be more sensitive to minor changes. Nevertheless, the findings to date suggest continuous development during childhood although the exact mechanisms of development have not been identified.

Recently, more attention has been paid to the changes that occur in late adulthood. For example, West and colleagues (West et al., 2012) in their study compared the ability to recognize facial expressions of emotions in adults, aged from 20 to 89. The oldest respondents (older than 60 years) showed reduced recognition of emotions such as anger, fear, and sadness. In contrast, the ability to recognize the emotion of disgust increased with age. Interestingly, happiness and surprise are recognized equally well in different age groups. Similar results were obtained by Orgeta and Philips (Orgeta & Philips, 2007) showing that there is a decrease in the ability to recognize sadness, anger, and fear in older people.

A review of the literature suggests that the type of stimulus used in the experiment may affect the obtained results (similar to the type of task in experiments with children). Thus, studies using static stimuli mostly give inconsistent results. Moreno (Moreno et al., 1993) showed that with age, the ability to recognize the emotion of happiness increased while the ability to recognize the emotion of sadness decreased. On the other hand, Isaacowitz and colleagues (Isaacowitz et al., 2007) showed only a reduced ability to recognize emotions of happiness and anger (and not any improvement). Finally, some studies (e.g., Calder et al., 2003) report that with age, there is an increase in the recognition of the emotion of disgust, while the ability to recognize the emotion of fear and anger decreases. In contrast to these studies, studies using animated stimuli (i.e., videos in which individual emotions are transformed into other basic emotions through fine sequences of photographs) show more consistent results. Thus, with age, there is a decrease in the recognition ability of emotions of fear, anger, and sadness (for example Montagne et al., 2007; Orgeta & Phillips, 2007) as well as the emotion of

happiness (Montagne et al., 2007). In the end, some studies (Lambrecht et al., 2012) show a significant decrease in the ability to recognize not only negative but also positive emotions in older adulthood.

How are changes in the success of recognizing different facial expressions of emotions during aging explained? Findings of the increased success of recognizing the facial expression of the emotion of happiness with aging are most often explained in terms of the Socioemotional selectivity theory (Löckenhoff & Carstensen, 2004). The basic premise of this theory is that as people are aging they begin to feel the need to reorganize life as well as life goals. With aging, a person may show a tendency to pay attention to the emotional aspects of events and focus more on emotionally satisfying social contacts instead of pursuing experiential goals. This phenomenon is called the age-related positivity effect (Baumeister et al., 2001). Because of such tendencies, older individuals could become more successful in recognizing positive facial expressions of emotions, while the ability to recognize negative emotions could decline (e.g., Moreno et al., 1993). Although attractive, this theory is unable to explain some of the above findings. For example, why would the recognition of the emotion of disgust improve? An additional problem for the Theory of Socioemotional Selectivity is the fact that improving the recognition of the emotion of happiness is not constantly shown. In the literature, there are conflicting findings, so Moreno and colleagues (1993) show improvement while some other studies (Montagne et al., 2007; Isaacowitz et al., 2007) show a decline in the ability to recognize emotions of happiness.

Despite the agreement that some changes in the recognition of facial expressions of emotions occur during aging, it is still unclear what the reason is. However, it seems that those changes are not consequences of impaired vision or basic perceptual abilities as well as impaired working memory and verbal intelligence (e.g., Lambrecht et al., 2012; West et al., 2012).

## Conclusion

Faces and facial expressions play an important role in social interactions. We are reading someone's emotional state and intentions based on facial expressions, but we are also signaling to others how we are feeling and whether we need comfort or space. There are shreds of evidence that some forms of facial expressions could be observed even at neonatal age, which clearly emphasizes the role of biology. Furthermore, numerous studies provided evidence for the universality of facial expressions of basic emotions (happiness, sadness, surprise, fear, anger and disgust). On the other hand, it was shown that facial expressions are under a clear cultural influence. For example, in some cultures, the recognition of negative emotions is worse (e.g. Japan) and in the same cultures, the displaying of these expressions in the presence of others is also less frequent. Interestingly, there is a growing body of lit-

erature that suggests that culture (and stereotypes) could also affect the judgment of emotions' intensity and the display of some expressions (that are seen as undesirable) could decrease the rating of facial attractiveness. Not surprisingly, language also affects our emotion recognition. Finally, studies also confirmed that living in unfavorable environments could also enhance our ability to recognize, for that context, more relevant emotions.

How is expertise in facial expressions recognition developed? Science still does not provide a definitive answer. The results (together with studies examining the development of facial expression recognition in children) suggest that generally speaking, the development of emotion recognition based on facial expression has the shape of the inverted letter U. However, it is important to keep in mind that this does not apply to individual emotions. For example, the development of recognizing the emotion of disgust would, judging by previous research, have a linear developmental function. Future research should provide more detailed answers to open questions regarding the recognition of facial expressions in elder people. What is certain is that the development of emotion recognition based on facial expressions does not stop in adolescence as it was thought until recently. Why changes occur at a later age is not known at this time and it seems that no theoretical framework can provide a satisfactory explanation for the occurrence of these changes.

## STATEMENT

In their statements, authors confirmed the absence of any conflict of interest.

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Datum prijave: 08.10.2022.

Datum prihvatanja: 18.01. 2023.

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