The Difference in Perception of a Duchenne Smile and a non-Duchenne Smile in terms of Ethnicity and Nationality

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Abstract

Previous literature revealed evidence that producing and perceiving Duchenne and non-Duchenne smiles can differ across and between various cultures and ethnicities and, as a result, can create difficulty in communication. However, other previous literature showed opposing and inconsistent results as well. Therefore, the inconsistent results concerning this topic led to the following research question: 'What is the difference in perception of a Duchenne smile and a non-Duchenne smile between in-group members and out-group members, in terms of ethnicity and nationality?'. The research question was answered by examining the differences in perception of 125 participants of several ethnicities en nationalities towards dynamic images of Duchenne or non-Duchenne smiles produced by people of different ethnicities. Each participant from a different nationality (Dutch/American/Chinese) and ethnicity (Caucasian/African American/Asian ethnicity) saw 12 different videos (Duchenne/non-Duchenne; Caucasian/African American/Asian ethnicity; male/female). Participants had to indicate the intensity of happiness of a video, and to judge whether the smile was real or fake. The findings indicated that people rate a Duchenne smile as happier than a non-Duchenne smile and that they can tell the difference between a Duchenne smile and a non-Duchenne smile. African Americans revealed a significant in-group advantage in terms of recognition of the smile and intensity of happiness rating. The results of this study provide some evidence for the fact that people who share the same ethnicity are better at recognizing emotions from their own ethnic group. However, there effect of ethnicity was not consistent across all groups of participants. Further research into the differences across various groups of ethnicities should be conducted to further elucidate this topic.

Introduction

Quickly and adequately decoding facial expressions is important in a pleasant social environment (Hugenberg, Wilson, See & Young, 2013; Niedenthal & Brauer, 2012). Being able to identify someone's facial expressions helps people understand someone's personality, characteristics, intentions and behaviour (Anderson & Thompson, 2004; Marsh, Kozak & Ambady, 2007). Thus, people who have difficulty understanding someone's facial expressions may encounter problems with communication (Ekman, 1992). Some people are better at recognizing emotions than others, and research has demonstrated that there are differences across cultures and ethnicities in perceiving and producing facial expressions, which makes understanding these emotions even more difficult (Elfenbein & Ambady, 2002).

One such a facial expression is the smile, which is a characteristic of a happy expression that is relatively easy to recognize (Maher, Ekstrom & Chen, 2014). When someone displays a true smile, your attitude towards that person will positively and significantly increase (Ekman & Friesen, 1982), which underscores the importance of the ability to produce and perceive a smile. Smiles can have many different functions; for example, a smile as part of a non-verbal expression can be displayed when we are interested (Mortillaro, Mehu & Scherer, 2011), embarrassed (Keltner, 1995; Keltner & Haidt, 1999) or proud (Tracy & Robins, 2007). Smiles always happen in a specific context or culture and can have different meanings such as a contemptuous smile, flirtatious smile or fake smile. The latter, if recognized, usually evokes a more negative than a positive attitude (Ekman & Friesen, 1982).

Not only can smiles have different functions, they can also look different. There are large differences in perceiving or producing a true or a fake smile, also called Duchenne or non-Duchenne smiles. A Duchenne smile can be described as a felt, enjoyed or genuine smile, whereas a non-Duchenne smile can be described as false, masking or polite (Duchenne, 1990). Though both smiles indicate a smiling mouth, Ekman and Friesen (1982) argued that there are several differences in appearance between Duchenne and non-Duchenne smiles. In addition to differences in appearance, there are also differences in receiving; Krumhuber and Manstead (2009) found that receivers respond more genuinely and positively to Duchenne than non-Duchenne smiles, which highlights the relevance of the topic.

Even though there are many studies that argue for the universal recognition of emotions (Ekman & Friesen, 1982), there also seem to be differences in facial recognition across various social and cultural groups (Kawakami, Amodio & Hugenberg, 2017; Masuda et al., 2008). For example, it appears that Westerners watch the entire face evenly, whereas Easterners tend to focus more on the eyes and ignore the mouth, which could affect how emotions are produced and perceived (Jack et al., 2009). This cultural difference also appears to be present when producing and perceiving differences in non-Duchenne and Duchenne smiles (Ambady & Weisbuch; Friesen et al., 2019; Mui, Gan, Goudbeek, Swerts, 2020).

Although some studies have examined the differences across nationalities or ethnicities in producing and perceiving Duchenne and non-Duchenne smiles (Ambady & Weisbuch; Friesen et al., 2019; Mui et al., 2020), research in this area is still limited. This study will therefore look at the differences in recognition when perceiving a non-Duchenne smile versus a Duchenne smile taking ethnicity and culture into account, where the latter will be measured by nationality. In other words, are people equally able to distinguish a non-Duchenne smile from a Duchenne smile when the smile originates from a speaker with another cultural or ethnic background as when the smile originates from a speaker with the same cultural or ethnic background?

Theoretical Framework

Communication can be defined as the transport of information from one person or location to another person or location. The part of communication without words or spoken language is called non-verbal communication, and it accounts for most of our communication (Mehrabian & Weiner, 1967). Ambady and Weisbuch (2010, p. 465) defined non-verbal communication as 'the sending and receiving of thoughts and feelings via non-verbal behaviour'. It includes the sense of time, use of space, eye contact, smell, use of touch, body language and silence (Hall, 1989). Non-verbal communication largely influences how individuals are perceived, respected and trusted (Thorstenson, Pazda, Elliot & Perrett, 2017). This indicates the important role of non-verbal communication and the cues we express. There are different forms of non-verbal communication, such as the use of paralanguage, body movement or facial expressions, but also someone's clothing or smell. Focusing on facial expressions, Ekman (1992) defined six basic communicative emotions expressed in facial expressions: anger, disgust, fear, sadness, surprise and joy. Of these six emotions, joy is the most easily recognized when compared to the other basic emotions (Elfenbein & Ambady, 2002). Joy can be expressed by the facial expression of a smile.

Smiles

A smile is a characteristic of a joyful expression, which people are able to recognize quite well (Maher, Ekstrom & Chen, 2014). The perception of a smile can play a critical role in interpersonal assessments and decision-making. As mentioned earlier, smiles can have different meanings; for example, a smile can be revealed when we are interested, embarrassed or proud (Keltner & Haidt, 1999; Mortillaro, Mehu & Scherer, 2011; Tracy & Robins, 2007). Ekman (1985) described 18 types of smiles, including smiles such as the contemptuous smile or the flirty smile. These smiles differ from one another in multiple ways, such as duration, magnitude and the circumstances in which they are expressed. One type of smile is a non-Duchenne smile, which can be recognized by the lack of activation of raising the cheek, where a Duchenne smile does display this activation (Duchenne, 1990; Ekman & Friesen, 1982). Some studies have found that non-Duchenne smiles evoke negative associations such as uncooperativeness or untruthfulness (Gunnery & Ruben, 2016; Krumhuber et al., 2007).

The American expression 'the smile did not reach his eyes' means that even though someone smiled, he or she was not really happy. Many people believe that when someone is truly happy, the smile is expressed through the eyes. This truly happy smile, also called Duchenne smile, reveals wrinkles around the eyes, a slight lowering of the outer eyebrow, a slight folding of the skin underneath the eyes, a small bend in the eyelid and the raising of the cheeks (Duchenne, 1990; Ekman & Friesen, 1982). On the other hand, the non-Duchenne smile demonstrates none of these characteristics. Many studies have examined the differences between Duchenne and non-Duchenne smiles and have found that Duchenne smiles evoke more positive reactions than non-Duchenne smiles, such as 'happier' and 'more amusing' (Duchenne, 1990; Ekman & Friesen, 1982). Additionally, Ekman and Friesen (1982) hypothesized that the relationship between trueness of the smile and intensity the smile, Duchenne versus non-Duchenne smile, was positively correlated. They confirmed this hypothesis in their study, which indicated that a Duchenne smile is rated as more *intense* than a non-Duchenne smile.

If we assume that there are differences in judgement towards Duchenne and non-Duchenne smiles, this could have consequences for social interactions. Krumhuber and Manstead (2009) found that receivers respond more genuinely and positively to Duchenne than non-Duchenne smiles. They asked 52 participants to rate Duchenne and non-Duchenne smiles on factors such as intensity, happiness, genuineness and positivity. They found that Duchenne smiles evoke more happiness than non-Duchenne smiles and correspondingly provoke more positive and social behaviours. However, these findings appeared only when dynamic displays were illustrated and were not present with static displays. Krumhuber and Manstead (2009) thus argue that Duchenne smiles can be distinguished from non-Duchenne smiles based only on a dynamic display but not on a static display. Therefore, in this study we will be using dynamic displays (i.e. videos) to test perception of the difference between Duchenne and non-Duchenne smiles. In line with Ekman and Friesen (1982), Krumhuber and Manstead (2009) found that Duchenne smiles were rated more intense in terms of happiness than non-Duchenne smiles. Based on these studies, the following hypothesis was formulated:

H1: The intensity in terms of happiness of the smile will be rated higher for Duchenne smiles than for non-Duchenne smiles.

When people smile, the context plays a significant role; after all, there is always a *reason* for the smile. For example, the situation – business, family or friends – could play a role, or the culture – someone's own culture or a foreign culture.

Culture and smiles

Just like smiles always happen in a specific context, they also appear in a certain culture, which influences the production and perception of the smile. Depending on the culture and the way of communicating in that culture, there could be differences in perception of a smile. Hofstede (1991) defined culture as 'the collective programming of the mind which distinguishes the members of one group or category of people from another' (p. 5). Differences in cultures can be found in factors such as behaviour, music preferences, communication manners, clothing styles, etcetera. In this research, we measure culture by someone's nationality. We assume someone's nationality to be closely related with someone's culture. Nationality is usually defined as the country or citizenship of a person, which generally has a significant impact on someone's culture (Hofstede, 1991). This is in line with previous studies where culture was also measured by nationality of the participant (Elfenbein & Ambady, 2002; Mui et al., 2020). The terms culture and nationality will be used interchangeably in this study. In line with the abovementioned differences between cultures, it has been found that recognition of facial expressions differs between different cultures. Elfenbein and Ambady (2002) examined the difference between in- and out-groups in recognition of emotions. They described an in-group as 'a group of people who identify with each other based on a variety of factors such as gender, race, religion or geography' (p. 204). Elfenbein and Ambady (2002) argued that recognizing an emotion is usually more accurate when the producer and perceiver of an emotion are from the same in-group.

Next to the in- group advantage, there are also differences across cultures in the recognition of facial expressions. A study by Jack et al. (2009) revealed differences in the decoding of facial expressions between Easterners and Westerners. When interpreting facial expressions, the researchers found various decoding strategies; where Westerners (European and American participants) watched all parts of the face equally, Easterners (Chinese and Japanese participants) focused towards the eyes, ignoring the mouth. These findings have an important implication, which is that people in the Chinese and Japanese cultures might use information from the eyes and mouth differently as compared to Americans and Europeans. In other words, the different focus areas of the face exhibited by Westerners and Easterners could explain a potential difference in interpretation of a smile and, therefore, cause potential miscommunication.

Mui, Goudbeek, Swerts and Hovasapian (2017) dived deeper into the differences between Westerners and Easterners concerning smiles and compared whether smiles and the intensity of smiles differed between Dutch and Chinese cultures. They found differences in smiles based on cultural and social factors. Chinese participants smiled more intensely when working in pairs than when working individually. This social difference was not found for Dutch participants, who smiled equally intensely when working in pairs as when working individually (Mui et al., 2017). This finding suggests that the intensity of a smile is influenced by the culture of a person. Mui et al. (2020) built on this previous work and examined whether the intensity of a smile is dependent on culture or the valence of the situation. They discovered

significant differences in rating the genuineness of a smile between the American participants and the Chinese participants, where the American observers gave lower genuineness ratings than the Chinese participants did in a negative situation (Mui et al., 2020). Their results provide evidence suggesting that the perceived genuineness of a smile is moderated by the culture of the perceiver. This finding could provide support for the idea that there are differences in producing and perceiving smiles between different cultures.

The abovementioned studies reveal that there are differences in the perception of facial expressions across different nationalities, however, there are also studies that found opposing results (Darwin, 1872; Ekman & Friesen, 1972; Keltner, 1995). A classic study by Ekman (1992) tested the universality of facial expressions and emotions by showing participants from 10 countries images of the facial expressions anger, disgust, fear, sadness and happiness. They found that the recognition of facial expressions and their related emotions is universal. The purpose of their study was to prove that specific facial expressions of basic emotions are universal and not culturally specific. However, their study was limited by the use of only static images.

Given our focus on the perception of (non-)Duchenne smiles, previous studies concerning the universality of facial expressions have some limitations. Firstly, most studies regarding the differences across nationalities in production and perception of emotions look at all sorts of expressions of emotions. However, there is a limited number of studies specifically on the perception of Duchenne and non-Duchenne smiles across nationalities. Additionally, these studies have examined the recognition of emotions, but not the recognition of genuineness of the emotion. Secondly, some studies have revealed evidence for the universal recognition of emotions, however, these studies were limited since they mostly used static images instead of dynamic images. Research has demonstrated that people are better at recognizing emotions from dynamic images (Krumhuber & Manstead, 2009). It could therefore be argued that those findings reveal incomplete results. This study focuses on perceptions from people from Dutch, Chinese and American cultures on Duchenne and non-Duchenne smiles, using dynamic images. Based on the existing theoretical knowledge of culture and facial expressions, the following hypothesis was formulated:

H2: People are better at recognizing Duchenne and non-Duchenne smiles produced by members from their own culture as compared to those produced by members from other cultures.

Ethnicity and smiles

Ethnicity can also influence the perception of a smile. James, Bailey and Garrick (2010) define an ethnic group as 'a named social category of people based on perceptions of shared social experience or one's ancestors' experiences' (p. 389). We saw earlier that culture could influence someone's perception of emotions and smiles (Elfenbein & Ambady, 2002; Matsumoto, 1989). Soto and Levenson (2010) found similar results based on ethnicity. They discovered that emotions are understood more accurately when they are perceived by in-group members of the same ethnicity. O'Toole et al. (1994) found similar results in the recognition of faces, in which same-ethnicity faces were more accurately and efficiently recognized than faces from other ethnicities. Therefore, looking at the previous research on facial recognition, it was

found that people can judge in-group members' expressions differently than out-group members, based on ethnicity.

Friesen et al. (2019) investigated ethnic biases focusing on the perception and recognition of smiles. Their findings demonstrate partial evidence for ethnic biases in identifying smiles, where Caucasian participants were better able to distinguish between Caucasian smile types than African American smile types. This bias was not found for African American participants, who did not differ in distinguishing smile types on Caucasian and African American faces. Friesen et al. (2019) found a possible explanation for the differences in emotion identification. The results from the eye-tracking data revealed that Caucasian participants spent longer looking at the eyes of Caucasian faces than the eyes of African American faces. This is an essential difference, since the difference between a Duchenne and a non-Duchenne smile can be found in the eyes.

Mai et al., (2011) found similar results for Asian participants (Chinese) regarding the role of the mouth and the eyes in identifying Duchenne or non-Duchenne smiles. They discovered that Asian people mainly trust the eyes to distinguish between Duchenne and non-Duchenne smiles. The difference between a Duchenne and a non-Duchenne smile lies in whether the muscles around the eyes are being used, and these need to be seen to recognize a smile as being Duchenne. Therefore, these findings could explain the results that Asian participants were better at recognizing Duchenne or non-Duchenne smiles. Additionally, the study by Friesen et al. (2019) indicated that participants differentiated happiness ratings, where Duchenne smiles were rated happier for in-group expressors than for out-group expressors (Friesen et al., 2019). Friesen et al. (2019) explained this result by the fact that the eye-tracking data demonstrated that participants spent more time looking at the overall face when a smile of another ethnicity was shown. However, when a smile of their own ethnicity was shown, participants looked more at the eyes, facilitating recognition of the Duchenne smiles (Friesen et al., 2019). This result implies a difference between someone perceiving an in-group (own ethnicity) Duchenne smile as compared to someone perceiving an out-group (different ethnicity) Duchenne smile, where the in-group member is rated as being happier.

The study by Friesen et al. (2019) examined only the differences between Caucasians and African Americans, and most other studies did not take ethnicity into account when analysing attitude towards Duchenne or non-Duchenne smiles. In this study we extend the comparison between different ethnicities in their recognition of Duchenne and non-Duchenne smiles, examining them from the perspective of different cultures (Dutch, Chinese, American) and ethnicities (African American, Caucasian, Asian). Additionally, where previous studies mainly used static images, this study uses dynamic images to test the differences, which should increase the accuracy of the results (Krumhuber & Manstead, 2009). Based on the literature, the following hypothesis was formulated:

H3: People are better at recognizing Duchenne and non-Duchenne smiles produced by members from their own ethnicity rather than those produced by members from other ethnicities.

This study

The theoretical basis provided above establishes that producing and perceiving Duchenne and non-Duchenne smiles can be different across in- and out-groups. Little research has been done on the differences in perception of Duchenne or non-Duchenne smiles while taking culture and ethnicity into account and based on dynamic images. In the current study we focus on perception in judging the happiness of the smile, and the ability of participants to differentiate between Duchenne and non-Duchenne smiles. Therefore, the following research question was formulated: *'What is the difference in perception of a Duchenne smile and a non-Duchenne smile between in-group members and out-group members, in terms of ethnicity and culture?'.*

The answers to this specific question will add to the current theoretical knowledge, which provides insufficient information due to several reasons. Firstly, many previous studies looked only at the recognition and perception of Duchenne and non-Duchenne smiles without considering culture or ethnicity. This is despite the fact that, based on previous literature, it is likely there will be differences based on ethnicity and culture (Friesen, et al., 2019; Mui et al., 2020). Contrary to many previous studies, this study takes into account the culture and ethnicity of the participant as well as the ethnicity of the person in the video. Additionally, many previous studies used static images, where this study includes dynamic images, which have been demonstrated to provide more reliable results in terms of recognizing Duchenne and non-Duchenne smiles (Krumhuber & Manstead, 2009).

Further knowledge into this topic helps us to understand how the process of producing and perceiving Duchenne and non-Duchenne smiles unfolds, which is useful in the development of communication strategies to improve in- and out-group relationships between various cultures. This means it could help people who communicate with members of different cultures in their international business communication strategies. Research has indicated that receivers respond more positively to Duchenne than to non-Duchenne smiles, and when someone displays a true smile, your attitude towards that person will be significantly more positive (Krumhuber & Manstead, 2009). By contrast, non-Duchenne smiles usually evoke more negative attitudes and negative associations such as uncooperativeness and untruthfulness (Gunnery & Ruben, 2016; Krumhuber et al., 2007; Thorstenson, Pazda, Elliot & Perrett, 2017). If, as hypothesized, the results indicate differences across cultures and ethnicities in the recognition of a Duchenne or non-Duchenne smile, people communicating in an international context should adjust their communication techniques and be aware of biases in decision-making and judgement. As mentioned in the theoretical framework, non-verbal communication accounts for the largest part of our communication (Mehrabian & Weiner, 1967), which highlights the need for understanding each other's facial expressions even more. For example, misjudging the type of smile of someone, could unrighteous negatively influence your opinion about that person.

Method

An experiment was conducted to provide answers to the research question: *'What is the difference in perception of a Duchenne smile and a non-Duchenne smile between in-group members and out-group members, in terms of ethnicity and culture?'*

Materials

A total of 12 short videos of people displaying a Duchenne or a non-Duchenne smile were shown to the participants to determine differences in perception of these smiles across various ethnicities and nationalities. Recordings of the smiles were collected from two different sources: the BBC Smile dataset (BBC, 2020) and the Gorodenkoff dataset (Gorodenkoff, 2020). The six videos from the BBC Smile dataset were gathered from 'Spot the fake smile', an experiment from the BBC website[1]. The complete BBC Smile dataset contained 10 real and 10 fake smiles, all on different faces. The videos were obtained by asking participants to either pose a smile as realistically as possible (non-Duchenne smile) or a funny video fragment was shown to evoke a Duchenne smile from the participant. Out of the total of 20 videos, six were selected since only those six met the criteria for ethnicity, gender and type of smile. The videos retrieved from the BBC database were all filmed from the same angle and same background (white). The other six videos were gathered from Gorodenkoff, an organization that creates videos for commercial purposes. For the purpose of this research, the Gorodenkoff organization shared the videos for free and we were able to use their materials. The videos from Gorodenkoff included some different backgrounds (colour and black). The videos were selected based on the relevant variables (ethnicity, gender and type of smile). Additionally, the videos that were chosen were selected to be most similar to the BBC videos. Image 1 is an example of a screenshot of one video from the BBC database, Image 2 is one example of a screenshot of a video from the Gorodenkoff database.

Image 1 - Screenshot of a Caucasian male, Duchenne smile, retrieved from the BBC database

Image 2 - Screenshot of an Asian male, Duchenne smile, retrieved from the Gorodenkoff database

[1] Website: http://www.bbc.co.uk/science/humanbody/mind/sur- veys/smiles/

Each participant was exposed to 12 different videos: six females and six males, with half of the males and half of the females showing a Duchenne smile and the other half a non-Duchenne smile. For each type of smile (Duchenne or non-Duchenne), there were six videos: an African American male and female, an Asian male and female and a Caucasian male and female. The same 12 videos were used for every participant but were shown at random order to different participants. Table 1 illustrates the details of the materials used in terms of type of dataset from which the video originated, gender, type of smile, ethnicity of the person in the video and duration of the video.

Table 1 - Details of the videos used for the experiment in terms of ethnicity of the person in the video, gender, type of smile, dataset from which the video originated, and duration of the video.

Ethnicity	**Gender**	**Type of smile**	**Dataset**	**Duration**
Caucasian	Male	Duchenne	BCC Database	3 seconds
Caucasian	Male	Non-Duchenne	BBC Database	3 seconds
Caucasian	Female	Duchenne	BBC Database	3 seconds
Caucasian	Female	Non-Duchenne	BBC Database	3 seconds
Asian	Male	Duchenne	Gorodenkoff	7 seconds
Asian	Male	Non-Duchenne	Gorodenkoff	3 seconds
Asian	Female	Duchenne	Gorodenkoff	3 seconds
Asian	Female	Non-Duchenne	BBC Database	4 seconds
African American	Male	Duchenne	Gorodenkoff	5 seconds
African American	Male	Non-Duchenne	BBC Database	4 seconds
African American	Female	Duchenne	Gorodenkoff	3 seconds
African American	Female	Non-Duchenne	Gorodenkoff	3 seconds

There were four different independent variables: type of smile, ethnicity of the person in the video, ethnicity of the participant and nationality of the participant. Firstly, the within-subject variable *type of smile* was manipulated by showing either a Duchenne or a non-Duchenne smile. Secondly, the within-subject variable *ethnicity* of the person in the video was manipulated by selecting videos including participants of African American, Asian or Caucasian ethnicities. These specific ethnicities were chosen based on previous research done on these groups (Friesen et al. 2019; Mui et al., 2020). The third independent variable was the *nationality* of the participant viewing the videos, being either Chinese, Dutch or American. These groups were selected based on previous research (Friesen et al. 2019; Mui et al., 2020; Mai et al., 2011). The last independent variable was *ethnicity* of the participant viewing the video, being either Asian, Caucasian or African American. These groups were selected based on previous research (Friesen et al., 2019; O'Toole et al., 1994; Soto & Levenson, 2010) and manipulated by sharing the experiment with people from those ethnicities. To allow for more generalization, participants viewed videos of both male and female smiling persons.

Subjects

Participants in the experiment consisted only of adults (age 18 and older) who spoke at least a basic level of English, as the experiment was conducted in English. Participants were recruited online through social media platforms such as Facebook, WhatsApp groups and WeChat groups. In total, data from 125 participants were gathered, of whom 82 (65.6%) were female and 43 (34.4%) were male. A chi-square test revealed no significant relationship between gender and ethnicity (χ^2 (2) = 3.59, p = .166) or gender and nationality (χ^2 (2) = 1.81, p = .771).

Ethnicity was not evenly distributed; there were 61 Caucasian participants as compared to 32 Asian and 32 African American participants. Nationality was equally distributed, with 46 American, 44 Dutch, 31 Chinese participants, and four other participants. Where the group 'others' consisted of two Canadian and two South African participants. The Canadian and South African participants were used only for the ethnicity analyses and were excluded from the nationality analyses since their groups representing nationality were too small.

The mean age was 29.94 (SD = 11.71) with a minimum age of 18 and a maximum age of 63. A one-way analysis of variance revealed no significant effect of ethnicity on age (F (2,122) = 1.01, p = .367) or nationality on age (F (2,120) < 1, p = .419) of the participants. This indicates that age was equally distributed across the various ethnicities and nationalities. Educational level ranged from 'less than high school' to 'master's degree or more'. A chi-square test revealed a significant relationship between educational level and ethnicity (χ^2 (2) = 24.41, p = .001), where Asian participants relatively often were categorized as 'master students / degree', and African Americans relatively often were categorized as 'high school students / degree'. Another chi-square test indicated a significant relationship between educational level and nationality (χ^2 (2) = 26.45, p = .048), with relatively many Chinese participants categorized as 'master students / degree'. This reveals that educational level was not equally distributed across the different variables. Most of the participants were highly educated, with 59.2% categorized as 'bachelor students / degree'.

Design

The experiment consisted of a mixed design including two between-subject factors: *nationality of the participant* (Dutch, Chinese, American) and *ethnicity of the participant* (Caucasian, African American, Asian) and two within-subject factors being: *type of smile* (Duchenne, non-Duchenne) and *ethnicity of the person in the video* (Caucasian, African American, Asian).

Instruments

The participants rated each smile on a 9-point scale in terms of intensity of happiness of the smile, and they evaluated whether they believed the smile to be a Duchenne or a non-Duchenne smile. Intensity was measured by asking the participant to indicate the happiness of the person in the video on a 9-point scale. This form of measurement was based on Friesen et al. (2019), who measured the intensity of the happiness on a 9-point scale from 1 (very unhappy) to 9 (very happy). Recognition of Duchenne or non-Duchenne smiles was measured by simply asking the participants 'the smile displayed in the video above is a…', where participants were able to click on either 'real smile' or 'fake smile'. After participants completed their assessments of the different smiles, they were asked to fill out several questions about their demographics: gender, age, nationality, ethnicity and level of education. After completion of the questionnaire, the participants were able to see which smiles they correctly recognized as Duchenne or non-Duchenne.

Procedure

Participants received a written explanation prior to the research about the purpose of the research. They were told that the experiment was performed to study how well people can recognize a real smile as compared to a fake smile. Participants were not told that the nationality or ethnicity of the participant and the ethnicity of the person in the video were manipulated. By continuing to the next page of the questionnaire, the participants agreed to being older than 18, having a basic level of English, and participating voluntarily. The level of English of the participants was asked to ensure that the questions were understood correctly, as they were written in English. After the introductory explanation, the participants were shown the 12 videos of different smiles (see materials). After each video, the participant was asked to score the smile on intensity of happiness and judge whether it was real or fake. After the participants watched and rated all 12 videos, they were forwarded to the demographical questions. The experiment took approximately five minutes. The procedure and experiment were exactly the same for every participant, and the participants did not receive any reward for joining in the experiment.

Statistical treatment

Several statistical procedures were used to test the results of this study. First, chi-square ($\chi 2$) analyses were used to measure any significant differences among the various cultural groups so that the data from the different groups could be compared equally. Additionally, a repeated measures analysis (ANOVA) was used to analyse the effect of the independent variables *smile* and *ethnicity* (as within-subject factors), and *nationality* and *ethnicity* of the participant (as a between-subject factor).

Results

Happiness of the smile

Several significant effects were noted following a repeated measures analysis for intensity of happiness of the smile, with the type of smile and the ethnicity of the person in the video as within-subject factors and the nationality and ethnicity of the participant as between-subject factors. The results are presented separately for each between-subject factor.

Table 2 illustrates the means and standard deviations of the effect of the nationality of the participant and the type of smile and ethnicity of the person in the video on the happiness rating. A significant main effect of ethnicity of the person in the video was found (F (2, 230) = 13.50, $p < .001$). Significant differences were noted among all different ethnicities in the videos, where African American people (M = 5.36, SD = 2.34) were rated significantly happier than Asian people (M = 4.70, SD = 1.90) and Caucasian people (M = 4.98, SD = 2.12). Caucasian people were rated significantly happier than Asian people, but significantly less happy than African American people. There was also a significant main effect of type of smile (F (2, 115) = 171.68, $p < .001$), where Duchenne smiles (M = 6.05, SD = 2.24) were rated significantly happier than non-Duchenne smiles (M = 3.82, SD = 1.79).

There was no main effect of nationality of the participant and no significant interaction effects were found among the nationality of the participant, the ethnicity of the person in the video, and the type of smile.

Table 2 – Means and standard deviations of the effect of nationality of the participant and ethnicity of the person in the video on the happiness rating, sorted by Duchenne and non-Duchenne smiles (1 = very unhappy; 9 = very happy).

	Caucasian M *(SD)*	Asian M *(SD)*	African American M *(SD)*	Total M *(SD)*
Dutch participant	6.39 (1.18)	6.41 (1.37)	6.51 (1.50)	6.47 (1.26)
Chinese participant	5.11 (1.71)	6.32 (2.00)	5.72 (1.65)	5.72 (1.11)
American participant	5.34 (1.30)	6.46 (1.44)	6.41 (1.50)	5.89 (2.58)
Total Duchenne	5.66 (1.47)	6.41 (1.56)	6.27 (1.56)	6.05 (2.24)
Dutch participant	4.61 (1.38)	2.97 (.90)	4.78 (1.37)	4.03 (.99)
Chinese participant	3.44 (1.52)	2.74 (1.01)	3.60 (1.49)	3.26 (.89)
American participant	4.74 (1.21)	3.12 (.85)	4.70 (1.29)	3.87 (2.10)
Total non-Duchenne	4.36 (1.45)	2.97 (.93)	4.45 (1.45)	3.82 (1.79)
Total	4.98 (2.12)	4.70 (1.90)	5.36 (2.34)	

Table 3 illustrates the means and standard deviations of the effect of ethnicity of the participant, type of smile, and ethnicity of the person in the video on the happiness rating. As discussed above, there was a significant main effect of ethnicity of the person in the video (F (2, 230) = 13.50, $p < .001$), and a significant main effect of type of smile (F (2, 115) = 171.68, $p < .001$). These significant differences are discussed above.

Table 3 – Means and standard deviations of the effect of ethnicity of the participant and ethnicity of the person in the video on the happiness rating, sorted by Duchenne and non-Duchenne smiles (1 = very unhappy; 9 = very happy).

	Caucasian M *(SD)*	Asian M *(SD)*	African American M *(SD)*	Total M *(SD)*
Caucasian participant	5.96 (1.27)	6.74 (1.23)	6.07 (1.42)	6.25 (1.09)
Asian participant	5.11 (1.68)	6.30 (1.97)	5.73 (1.62)	5.61 (2.11)
African American participant	5.66 (1.49)	5.82 (1.55)	7.29 (1.34)	6.30 (1.19)
Total Duchenne	5.66 (1.47)	6.41 (1.56)	6.27 (1.56)	6.05 (2.24)
Caucasian participant	4.78 (1.26)	3.18 (.84)	4.67 (1.26)	4.21 (.93)
Asian participant	3.47 (1.51)	2.72 (1.05)	3.58 (1.47)	3.21 (2.55)
African American participant	4.47 (1.38)	2.79 (.90)	4.95 (1.43)	4.03 (.94)
Total non-Duchenne	4.36 (1.45)	2.97 (.93)	4.45 (1.45)	3.82 (1.79)
Total	4.98 (2.12)	4.70 (1.90)	5.36 (1.35)	

These main effects were qualified by a significant interaction effect between the ethnicity of the person in the video and the ethnicity of the participant (F (4, 230) = 7.91, p < .001). A pairwise comparison indicated that Caucasian participants rated Asian people (M = 4.97, SD = .94) as significantly less happy than African American people (M = 5.36, SD = 1.71) and Caucasian people (M = 5.35, SD = 1.02). Additionally, African American participants rated African Americans happier than Caucasians and Asians and rated Caucasians as significantly happier than Asians. Means and standard deviations of these interactions can be found in Table 4. There were no significant differences for the Asian participants.

Table 4 - Means and standard deviations of the effect of ethnicity of the participant and ethnicity of the person in the video on the happiness rating (1 = very unhappy; 9 = very happy).

	Caucasian M *(SD)*	Asian M *(SD)*	African American M *(SD)*
Caucasian participant	5.35 (1.02)	4.97 (.94)	5.36 (1.71)
Asian participant	4.51 (2.98)	4.14 (2.55)	4.58 (2.22)
African American participant	5.07 (1.13)	4.30 (.96)	6.13 (1.19)

Another significant interaction effect was found between the ethnicity of the person in the video and the type of smile (F (2, 230) = 25.07, p < .001), where Duchenne smiles from Caucasian people were rated less happy (M = 5.57, SD = 2.03) than Duchenne smiles from African American people (M = 6.41, SD = 1.53). For non-Duchenne smiles, Asian people (M = 2.77, SD = .96) were rated significantly less happy than Caucasian people (M = 4.38, SD = 1.95) and African American people (M = 4.30, SD = 1.47). The means and standard deviations can be found in Table 5.

Table 5 - Means and standard deviations of the effect of ethnicity of the video and type of smile on the happiness rating (1 = very unhappy; 9 = very happy).

	Duchenne smile M *(SD)*	Non-Duchenne smile M *(SD)*
Caucasian	5.57 (2.03)	4.38 (1.95)
Asian	6.17 (1.64)	2.77 (.96)
African American	6.41(1.53)	4.30 (1.47)

No further significant interaction effects on the happiness rating were found.

Correctness of recognition of Duchenne or non-Duchenne smiles

Correctness of recognition of Duchenne or non-Duchenne smiles was measured by recognition being either correct (1) or incorrect (0), where the videos of the two genders (male and female) were combined to a mean score for each condition. This provided mean scores per condition between 0 and 1 on the percentage of correctness of the recognition of Duchenne or non-Duchenne smiles. This means that the binomial data was changed into ratio data to enable the analyses to be performed. Based on these mean scores for each condition, a repeated measures analysis was performed. Several significant effects were found for correctness of recognition of the smile with the type of smile and the ethnicity of the person in the video as a within-subject factor and the nationality of the participant and the ethnicity of the participant as

between-subject factors. The results are presented separately for each between-subject factor.

Table 6 illustrates the means and standard deviations of the effect of nationality of the participant, type of smile, and ethnicity of the person in the video on the percentage correctness of recognizing a smile. There was a significant main effect of the type of smile (F (1, 114) = 8.053, p = .005), where Duchenne smiles (M = .73, SD = .45) were more often correctly recognized than non-Duchenne smiles (M = .59, SD = .56). There were no other main effects on the percentage of correctness of recognition of Duchenne and non-Duchenne smiles. Neither were there significant interaction effects among the type of smile, the nationality of the participant and the ethnicity of the person in the video.

Table 6 – Means and standard deviations of the effect of nationality of the participant and ethnicity of the person in the video on the percentage correctness of recognizing a Duchenne or non-Duchenne smile, sorted by Duchenne and non-Duchenne smiles (0 = completely incorrect; 1 = completely correct).

	Caucasian M *(SD)*	Asian M *(SD)*	African American M *(SD)*	Total M *(SD)*
Dutch participant	.67 (.32)	.75 (.33)	.65 (.30)	.71 (.20)
Chinese participant	.66 (.37)	.74 (.34)	.74 (.34)	.72 (.22)
American participant	.58 (.40)	.77 (.29)	.69 (.34)	.74 (.47)
Total Duchenne	.63 (.37)	.75 (.32)	.69 (.32)	.73 (.45)
Dutch participant	.66 (.35)	.59 (.38)	.60 (.37)	.61 (.27)
Chinese participant	.73 (.31)	.55 (.37)	.69 (.36)	.66 (.22)
American participant	.64 (.36)	.42 (.34)	.68 (.40)	.56 (.54)
Total non-Duchenne	.67 (.35)	.52 (.37)	.65 (.35)	.59 (.56)
Total	.65 (.56)	.66 (.56)	.66 (.45)	

Table 7 illustrates the means and standard deviations of the effect of ethnicity of the participant and ethnicity of the person in the video on the percentage correctness of recognition of a Duchenne or non-Duchenne smile. As discussed above, the repeated measures analysis revealed a significant main effect of the type of smile (F (1, 114) = 8.053, p = .005). The significant differences are discussed above.

Table 7 – Means and standard deviations of the effect of ethnicity of the participant and ethnicity of the person in the video on the percentage correctness of recognizing a Duchenne or non-Duchenne smile, sorted by Duchenne and non-Duchenne smiles (0 = completely incorrect; 1 = completely correct).

	Caucasian M *(SD)*	Asian M *(SD)*	African American M *(SD)*	Total M *(SD)*
Caucasian participant	.63 (.36)	.73 (.31)	.60 (.30)	.65 (.23)
Asian participant	.67 (.37)	.75 (.34)	.73 (.34)	.77 (.57)
African American participant	.61 (.37)	.82 (.31)	.82 (.31)	.75 (.23)
Total Duchenne	.63 (.67)	.75 (.32)	.69 (.32)	.73 (.45)
Caucasian participant	.70 (.31)	.50 (.38)	.58 (.36)	.59 (.23)
Asian participant	.72 (.31)	.55 (.37)	.69 (.35)	.58 (.68)
African American participant	.55 (.44)	.52 (.35)	.77 (.32)	.61 (.28)
Total non-Duchenne	.67 (.35)	.52 (.37)	.65 (.35)	.59 (.56)
Total	.65 (.56)	.66 (.56)	.66 (.45)	

A repeated measures analysis of percentage correctness of recognition of the smile with the type of smile and the ethnicity of the person in the video as within-subject factors and ethnicity of the participant and nationality of the participant as between-subject factors indicated a significant interaction effect between ethnicity of the person in the video and ethnicity of the participant (F (4, 228) = 3.93, p = .004). A pairwise comparison for the repeated measures revealed that African American participants correctly recognized smiles from African American people (M = .78, SD = .28) significantly more often than smiles from Caucasian people (M = .58, SD = .28). Means and standard deviations of these results can be found in Table 8. There were no significant differences for Caucasian or Asian participants.

Table 8 - Means and standard deviations of the effect of ethnicity of the participant and ethnicity of the video on the on the correctness in recognition of a smile (0 = completely incorrect; 1 = completely correct).

	Caucasian video M *(SD)*	Asian video M *(SD)*	African American video M *(SD)*
Caucasian participant	.66 (.31)	.61 (.23)	.59 (.23)
Asian participant	.72 (.79)	.70 (.68)	.61 (.68)
African American participant	.58 (.28)	.68 (.28)	.78 (.28)

A repeated measures analysis also indicated a significant interaction effect between the ethnicity of the person in the video and the type of smile (F (2, 228) = 4.79, p = .009), where Duchenne smiles from African American people (M = .81, SD = .34) were significantly more often correctly recognized than non-Duchenne smiles from African American people (M = .51, SD = .40). Means and standard deviations of these results can be found in Table 9. There were no significant differences between recognition of the type of smile for the videos with Caucasian or Asian people.

Table 9 - Means and standard deviations of the effect of ethnicity of the person in the video and type of smile on the percentage correctness in recognition of a smile (0 = completely incorrect; 1 = completely correct).

	Duchenne smile M *(SD)*	Non-Duchenne smile M *(SD)*
Caucasian	.69 (.55)	.62 (.47)
Asian	.68 (.34)	.65 (.40)
African American	.81 (.34)	.51 (.40)

No other significant interaction effects were noted for percentage correctness in recognition of the smile.

Discussion and Conclusion

The aim of this study was to look at the differences in perception towards dynamic images of Duchenne or non-Duchenne smiles while considering the effects of nationality or ethnicity. Each participant from a different nationality (Dutch/American/Chinese) and ethnicity (Caucasian/African American/Asian) viewed 12 different videos (Duchenne/non-Duchenne; Caucasian/African American/Asian ethnicity; male/female). The effects of ethnicity and nationality were measured by asking the participants to indicate the intensity of happiness of the smile featured by the person in the video, and correctness in judgement was measured by asking participants whether the smile in the video was real or fake.

Happiness rating of the smile

Ekman and Friesen (1982) and Krumhuber and Manstead (2009) argued that Duchenne smiles are rated more intense in terms of happiness than non-Duchenne smiles. Based on those studies, the following hypothesis was formulated: '*The intensity in terms of happiness of the smile will be rated higher for Duchenne smiles than for non-Duchenne smiles'.* The present study confirmed this hypothesis, in line with previous studies (Ekman & Friesen, 1982; Krumhuber & Manstead, 2009) where there was a main effect of the type of smile in a rating of happiness towards Duchenne or non-Duchenne smiles. The results indicated that Duchenne smiles were rated happier than non-Duchenne smiles, which proves that people do recognize a non-Duchenne smile as less happy, and that these can thus be considered as 'untrue' or 'fake' smiles. This result emphasizes the effect of the Duchenne smile expression, which evokes a happier evaluation from the receiver than a non-Duchenne smile. Krumhuber and Manstead (2009) found that a happier evaluation results in more positive and social behaviour between the expressor and the receiver. This positive behaviour also results in better cooperation and communication between the expressor and receiver of the smile. Therefore, since people tend to rate a Duchenne smile as happier, this finding could be used to help improve communication strategies. For example, it could be advised to create more awareness about the differences in effects of Duchenne and non-Duchenne smiles among people who communicate internationally with people of various nationalities. This advice should contain information about the uncooperative and untruthful associations non-Duchenne smiles tend to evoke, and the positive effects of the expression of a Duchenne smile (Krumhuber & Manstead, 2009). However, the question is whether people have a choice in which smile to use, and whether they are able to 'force' a real smile when they are not really happy. An interesting topic for further research would be to examine whether a neutral face evokes fewer negative associations than a non-Duchenne smile does and whether Duchenne smiles can be imitated if people would be aware of the positive effects.

There was also a main effect of ethnicity of the person in the video. When ignoring the difference between Duchenne and non-Duchenne smiles, a difference in the happiness rating of the smile was found among the various ethnicities depicted in the videos. Overall, African American people were rated happier than Asians and Caucasians. Caucasian people were rated happier than Asians, but less happy than African Americans. It could be argued that these results derive from differences in the expressions of emotions. Many studies have proven that the recognition of emotions is universal (Darwin, 1872; Ekman, 1992; Ekman & Friesen, 1982;

Keltner, 1995), which this study also confirmed. However, the results of this study could question the universality of smile expressions. It could be that people do universally express the same emotion, but that within a specific emotion, there are still differences across cultures in how exactly this emotion is expressed. Further research should examine the differences among various cultures and ethnicities in expressions of Duchenne and non-Duchenne smiles.

Focusing on the differences in evaluation between Duchenne and non-Duchenne smiles from people of different ethnicities, this study found several interaction effects of the type of smile and ethnicity of the person in the video on the happiness rating of the smile. Caucasian Duchenne smiles were rated less happy than African American Duchenne smiles. Additionally, Asian non-Duchenne smiles were rated less happy than Caucasian and African American non-Duchenne smiles. The fact that there were differences in ratings of happiness could derive from several causes. It could be argued that these results derive from the differences in expression of joy and excitement across different ethnicities. A study by Schimmack, Oishi and Diener (2002) found that people in European (Caucasian) and African American cultures express more joy and excitement whereas people in Asian cultures tend to be more hesitant in expressing positive emotions. Even though many studies have argued that the expression of emotions is universal, this finding could implicate that the difference between Duchenne and non-Duchenne smiles might not be as straightforward. It could be that there is more variation between the Duchenne and non-Duchenne smiles and that the groups are not binary. For example, difference between a Duchenne and non-Duchenne smile could be a more gradient scale where people are seen happier and less happy, instead of one or the other. Our findings only looked at the rating in happiness of a person, but no further analyses of the facial expression were made. Further research should focus on whether there are differences between the faces and expressions of Duchenne and non-Duchenne smiles of various ethnicities.

The results of this study revealed an interaction effect of ethnicity of the participants and ethnicity of the video on the happiness rating of a smile, which was in line with our expectations. A previous study by Friesen et al. (2019) indicated that participants differentiated on happiness ratings, where Duchenne smiles were rated happier for in-group expressors from the same ethnicity than for out-group expressors from different ethnicities (Friesen et al., 2019). Based on this, in this study we expected that smiles produced by people from the same ethnicity as the participant would be rated higher in terms of happiness than smiles produced by people from a different ethnicity than the participant. The results partly confirmed this expectation, where African American people rated smiles produced by African Americans as happier than Asian and Caucasian smiles (in-group advantage effect). However, this result was not found for the other ethnicities. One possible explanation could be that the results concerning 'correctness in recognition of a smile' (to be discussed in more detail below) revealed that African American participants were better at distinguishing a Duchenne smile from a non-Duchenne smile from in-group members, and that this influenced the ratings for happiness. Friesen et al. (2019) argued that 'intergroup contexts can influence attention to targets' eyes, which in turn impacts emotion recognition' (p. 388). In other words, when receiving an emotion from an in-group member, it could affect recognition of the emotion and, correspondingly, the judgement of this emotion. However, this research only confirmed this for the African American participants. Therefore, the results on this topic are slightly inconclusive with the claim that an in-group advantage exists, and that in line with Elfenbein and Ambady (2002),

recognition of an emotion is usually more accurate when the producer and perceiver of the emotion are from the same in-group.

However, the question remains why Asian and Caucasian participants did not display this in-group advantage effect. One explanation for this could lie in the extent to which people affiliate with their own ethnicity or nationality. Participants self-evaluated their own ethnicity and nationality, and their relationship with their cultural or ethnic background was not measured. It could be that for some ethnicities, ethnic background plays a bigger role than for other ethnicities. However, since we do not know how much the participants actually associate with their backgrounds, we do not know whether this is the case. Further research is suggested to include examining the role of ethnicity towards the happiness rating of a Duchenne or non-Duchenne smile.

The results indicated that happiness ratings of the smiles were affected by ethnicity, both of the participant and of the person in the video, and type of smile, as explained above. However, no effect of nationality on the happiness rating was found. This is an interesting finding, since several significant differences were related to a person's ethnicity. Based on the effects of ethnicity of the participant, you could expect that those effects would also be visible, for the nationality of the participant to some extent, if we assume that ethnicity and nationality are often related. This finding leads to a question about the validity of previous research, where often only ethnicity or nationality was questioned, but usually not both. This underlines the fact that we cannot equate nationality to ethnicity, so it is important to always include both. This study included ethnicity and nationality of the participant, but only showed ethnicity of the person in the video. Since nationality cannot be compared to ethnicity, further research should include nationality in the videos as well to improve measuring the effects of nationality.

Correctness in recognition of a smile

The second dependent variable, regarding the correctness in recognizing a Duchenne or non-Duchenne smile, and whether this was affected by ethnicity or nationality, revealed several interesting findings. Firstly, the results indicate that participants more often judged a smile correctly than incorrectly, where Duchenne smiles were correctly judged in 73% of the cases, and non-Duchenne smiles were correctly judged in 59% of the cases. These results indicate that people are quite good at recognizing a Duchenne smile and a non-Duchenne smile. Overall it was found that Duchenne smiles were more often correctly recognized than non-Duchenne smiles.

Our second hypothesis was: '*People are better at recognizing Duchenne and non-Duchenne smiles produced by members from their own culture as compared to those produced by members from other cultures'.* In this study, nationality was used as a measure of culture, and this study focused on the Dutch, Chinese and American nationalities specifically to examine the effect of nationality. The results revealed no effect of nationality on correctness in recognizing a smile, which indicates that Dutch, Chinese and American people performed equally well in recognizing any smile. Neither were there any interaction effects based on the nationality of the participant and ethnicity of the person in the video on the correctness of recognizing the smile. Therefore, this finding does not confirm our second hypothesis which shows that there was no effect of nationality of the participant. The effects of ethnicity on

correctness in recognition of a smile discussed below do show several significant effects, which is not in line with the results on nationality. As discussed, it is advised that further research includes both nationality and ethnicity, since results show that nationality cannot be compared to ethnicity.

Secondly, we looked at the effects of the ethnicity, of the person in the video and participant, of the smile on correctness in recognizing a Duchenne or non-Duchenne smile. Our hypothesis, that *'People are better at recognizing Duchenne and non-Duchenne smiles from their own ethnicity rather than those from other ethnicities',* was based on the study by Friesen et al. (2019). These researchers examined ethnic biases in the perception and recognition of smiles and found partial evidence for ethnic biases in identifying smiles. We found an interaction between the ethnicity of the person in the video and the ethnicity of the participant, where African American participants correctly recognized smiles from African Americans more often than smiles from Caucasians. This finding confirms our hypothesis that people are better at recognizing a Duchenne or non-Duchenne smile from their own ethnic group than smiles from another ethnic group, indicating an in-group advantage. The in-group advantage – where people tend to (unconsciously) more easily affiliate with their own 'in-group' as compared to their 'out-group' – could explain this result. However, this finding was present only for African American participants, and Caucasian and Asian participants did not differentiate in the correct recognition of a smile. Interestingly, this finding is in line with the happiness rating scores where African Americans rated smiles from their own ethnicity as happier as well. By contrast, the other two ethnic groups of Asian and Caucasian participants did not mirror this result.

The results show that there are differences across ethnic groups concerning correctness in recognition of a smile. As explained in the theoretical framework, a difference in recognition of a smile (incorrectly indicating a smile as a Duchenne or non-Duchenne smile) is a probable cause for miscommunication (Friesen et al., 2019; Mui et al., 2020). Therefore, it is advised to educate people regarding the differences in perception of Duchenne and non-Duchenne smiles. As discussed, non-verbal communication accounts for the largest part of our communication, however, compared to verbal communication, it is much more difficult to control (Mehrabian & Weiner, 1967). Displaying a non-Duchenne smile could mislead and cause miscommunication. Therefore, in addition to the previous advice of 'forcing' the expressor to express a Duchenne smile even though he or she is not happy, it is also recommended to focus on the receiver of the smile. Hence, instead of only improving someone's expression, correctly perceiving the smile should be improved as well. Friesen et al. (2019) argued that a correct judgement of a negative emotion could be more beneficial than an incorrect judgement of a positive emotion. For example, knowing that someone is not happy, even though someone is displaying a smile could help you understand that person and correspondingly communicate better, than when you are uncertain about someone's emotion.

Limitations and further research

This research had some limitations, which are now discussed, and several suggestions for further research are provided.

Firstly, an element of the current work that might be regarded as a limitation concerns the way in which intensity of happiness of the smile was measured. Incorrect answers regarding the Duchenne and non-Duchenne smile were also included in the rating of intensity of happiness of the smile. In other words, in scores for happiness ratings, all data were used, including the data where a participant did not recognize a smile correctly for being Duchenne or non-Duchenne. One could argue that if someone incorrectly judged a smile (e.g., judged a non-Duchenne smile as being a Duchenne smile), the intensity rating of that smile should not be included, since the intensity rating of happiness might depend on the judgement of a Duchenne or non-Duchenne smile. For example, if someone judges a smile as being Duchenne, the score for the happiness rating will most likely be on the upper end of the scale (between 5 and 9). However, when the smile is actually a non-Duchenne smile, this happiness rating might convey the wrong impression. For this study, it was decided to consider all data regarding the intensity of happiness of the smile. However, for further research it might be relevant to examine whether intensity of happiness of the smile depends on the correct recognition of a smile, and therefore whether to consider only intensity scores for those cases where the smile was correctly recognized.

Secondly, the variations in effects across the different groups of ethnicities invite further investigation. The results of this research indicated varying results for the three examined ethnicities (Asian, Caucasian and African American). Other previous research revealed effects of context or valence of the situation for example (Mui et al., 2020). Further research should determine to what degree the differences actually originate from ethnicity or derive from another cause such as situational factors, the type of video, social status, nationality, etcetera.

Additionally, several theories (Friesen et al., 2019; Jack et al., 2009; Mai et al., 2011) have suggested that visual attention is culturally dependent and that the focus of the eyes can play a role in the recognition of emotions. With the use of eye-tracking studies, further research could focus on the role of the eyes in whether nationality or ethnicity affects the recognition of Duchenne and non-Duchenne smiles. The usage of eye-tracking data can provide insight into why there was an in-group advantage for African Americans but not for the other ethnic groups.

Finally, this research was limited in that it examined only three ethnicities: African American, Caucasian and Asian people. Further research should look at other ethnicities as well, since the results of this research indicated differences in in-group advantages could exist across different ethnicities. Where African Americans demonstrated an in-group effect, this result was not present for Asian and Caucasian participants. Furthermore, this research consisted of only two videos per condition (male and female), and the argument could be made that therefore these results are not generalizable. Further research should use more videos to explore the effect of ethnicity and nationality on the ability to recognize Duchenne and non-Duchenne smiles and rate them for happiness.

Conclusion

The studies discussed at the beginning of this paper revealed a gap in the literature that led to the main research question: '*What is the difference in perception of a Duchenne smile and a non-Duchenne smile between in-group members and out-group members, in terms of ethnicity and culture?*'. In this study, perception was measured by the perceived happiness of the smile and by the ability of participants to differentiate between Duchenne and non-Duchenne smiles. Where many previous studies were limited in using only static images instead of dynamic images, and by not considering nationality or ethnicity, this study used videos and included the ethnicity and nationality of the participants as well as the ethnicity of the person in the video as factors in the design.

Firstly, the results of this study revealed that, in terms of the happiness rating of a smile, it was found that Duchenne smiles are perceived as happier than non-Duchenne smiles. There was also a main effect of the ethnicity of the person in the video on the happiness rating, where African American people were rated happier than Asians and Caucasians. Caucasian people were rated happier than Asians, but less happy than African Americans. Focusing on the differences in evaluation of Duchenne and non-Duchenne smiles from different ethnicities, this study found several interaction effects of the type of smile and the ethnicity of the person in the video on the happiness rating of the smile. Caucasian Duchenne smiles were rated less happy than African American Duchenne smiles. Additionally, Asian non-Duchenne smiles were rated less happy than Caucasian and African American non-Duchenne smiles.

The results of this study revealed a main effect of ethnicity of the participants on the happiness rating of a smile, which was in line with our expectations. The results confirmed our first hypothesis: '*The intensity in terms of happiness of the smile will be rated higher for Duchenne smiles than for non-Duchenne smiles*'. Additionally, the results indicated that, in the happiness rating of the smile, there were effects of ethnicity, both of the participant and of the person in the video, and type of smile, as explained above, where African Americans rated smiles produced by African Americans as happier than Asian and Caucasian smiles (in-group advantage effect). However, this result was not found for the other ethnicities. Additionally, no effect of nationality on the rating of happiness was found.

The second dependent variable – the correctness in recognition of a Duchenne or non-Duchenne smile and whether this was affected by ethnicity or nationality – revealed several interesting findings. Firstly, the results indicate that participants judged a smile correctly more often than incorrectly. Overall it was found that Duchenne smiles were more often correctly recognized than non-Duchenne smiles. The results indicated no effect of nationality on correctness in recognition of the smile, which indicates that Dutch, Chinese and American people performed equally well in recognizing any smile. Neither were there any interaction effects based on the nationality of the participant and ethnicity o the person in the video on the correctness in recognizing the smile. Therefore, this finding does not confirm our second hypothesis, which was: '*People are better at recognizing Duchenne and non-Duchenne smiles produced by members from their own culture as compared to those produced by members from other cultures'*.

Secondly, we looked at the effects of ethnicity of the person in the video and of the participant on the correct recognition of a Duchenne or non-Duchenne smile. We found an

interaction between the ethnicity of the person in the video and the ethnicity of the participant, where African American participants correctly recognized smiles from African Americans more often than smiles from Caucasians. This finding partially confirms our hypothesis that: *'People are better at recognizing Duchenne and non-Duchenne smiles from their own ethnicity rather than those from other ethnicities'*, which indicates an in-group advantage. However, this finding was present only for African American participants, and Caucasian and Asian participants did not differentiate in correct recognition of a smile.

To conclude, and to answer the main research question: '*What is the difference in perception of a Duchenne smile and a non-Duchenne smile between in-group members and out-group members, in terms of ethnicity and culture?*', people do rate a Duchenne smile as happier than a non-Duchenne smile, and people can mostly distinguish a Duchenne smile from a non-Duchenne smile, where it is easiest to recognize a Duchenne smile. However, there is no consistent effect of ethnicity across the African American, Asian and Caucasian groups of participants. Therefore, although the results of this study provide some indication for in-group advantages, this does not appear to hold true across all ethnicities. This research indicated that receivers find Duchenne smiles happier than to non-Duchenne smiles, which correspondingly indicates a more positive attitude towards the expressor of the smile. The results partly indicate, as hypothesized, that some differences exist across ethnicities in the recognition and happiness rating of a Duchenne or non-Duchenne smile. Therefore, people communicating in an international context should be aware of their communication techniques and biases in decision-making and judgements. Expressing and perceiving Duchenne and non-Duchenne smiles should be developed to improve in- and out-group relationships between various cultures and ethnicities.

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