



## REVIEW

# Facial Expression Recognition of Portuguese using American Data as a Reference

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### ABSTRACT

It is unknown if the ability of Portuguese in the identification of NimStim data set, which was created in America to provide facial expressions that could be recognized by untrained people, is (or not) similar to the Americans. To test this hypothesis the performance of Portuguese in the recognition of Happiness, Surprise, Sadness, Fear, Disgust and Anger NimStim facial expressions was compared with the Americans, but no significant differences were found. In both populations the easiest emotion to identify was Happiness while Fear was the most difficult one. However, with exception for Surprise, Portuguese tend to show a lower accuracy rate for all the emotions studied. Results highlighted some cultural differences.

## 1. Introduction

Several studies have shown that the facial expression of basic emotions can be universally recognised [2,9]. Indeed, more than 30 studies have suggest this universality of recognition [11] and a meta-analysis of 168 datasets examining judgments of emotion in nonverbal stimuli (including facial expression) indicated universal emotion recognition above chance levels [5]. More than 75 studies have pointed basic facial expressions are produced when emotions are elicited spontaneously [14] and other research showed that the production of spontaneous facial expressions of emotion is not dependent on observational learning [10]. However, Elfenbein, Mandal, Ambady, Harizuka and Kumar (2004) highlighted that some studies above mentioned also prove for cultural differences, once American performed

better than others using American stimuli. For example, using American emotional facial expressions, accuracy rates of 86% were described for participants of the United States [2], and 52% for members of the Borneo Sadong tribe [4]. In another study American participants correctly identified 83% of stimulus, European groups 75 to 83%, Japanese 65%, and Africans 50% [8]. In turn, Elfenbein and Ambady (2003) compared Chinese located in China and in the United States, Chinese Americans, and non-Asian Americans, Tibetans residing in China and Africans residing in the United States, and propose that these differences on accuracy rates could be explained by a intragroup advantage based in subtle differences in style across cultures, that improved with bigger contact [6]. However, that intragroup advantage has not been found in the studies of Matsumoto and Willingham (2009) us-

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ing photographs spontaneity and not posed.

Other studies have shown that there are some differences in the interpretation of facially expressed emotions in people from different cultures. For example, Shioiri, Someya, Helmeste and Tang (1999) found that, in spite of using Japanese stimulus, the young Japanese sample experienced difficulties in recognizing some emotional facial expressions and misunderstood others, when compared to previous studies using American subjects. A possible explanation could be the advanced by Yuki, Maddux, and Masuda (2007), who showed that when judging emotions Americans give primacy to mouth cues while Japanese tend to valorise eye cues.

The reasons for the disagreement in the findings could be related to differences in the methodology used, namely the previewing of slides, judgement context, presentation order, the use of posed expression and type of response format <sup>[1]</sup>, as well as the own stimuli used. Indeed, one of the main problems in research on the identification of facial expressions is the difficulty in finding stimuli that accurately assess the emotions we want to evaluate and to have a large database of validated stimuli with different people expressing different emotions <sup>[19]</sup>.

A broad set of face posed stimuli called NimStim was created in America to provide facial expressions that could be recognized by untrained people <sup>[18]</sup>. This set, which is available online and can be used by the scientific community around the world, has never been applied in Portugal. As such, it is unknown if the ability of Portuguese in the identification of NimStim facial expressions is (or not) similar to the Americans. To test this hypothesis we compare the performance of Portuguese in the recognition of NimStim facial expressions with data published in the literature for similar experiments performed with Americans.

## 2. Material and Methods

### 2.1 Participants

269 Portuguese citizens (109 males and 160 females) volunteers recruited by advertising with ages between 18 and 35 years old (Mean Age = 26.45 years old, Standard Deviation = 5.55), and different number of years of vertical schooling (Maximum = 19, Minimum = 3; Mean = 11.92, Standard Deviation = 2.98), were selected. These people were living either in urban centres or in the country.

### 2.2 Materials

A shortened version of the original NimStim study <sup>[18]</sup>, comprising 515 photographs which achieved more than

50% of correct answers in the original study of 672 images used by Tottenham et al. (2009), was used. These pictures such as in the original study are of professional actors (14 men and 18 women), of various ethnic groups (10 African, 6 Asian, 25 European, 2 Latin-American), facially expressing the six basic emotions (happiness, disgust, fear, anger, sadness and surprise) and also calm and neutral faces. The colour photographs were mounted on a white background.

The selected set of photographs was beforehand shown to a heterogeneous group of 20 participants as a way of checking the clarity, meaning and accuracy of the words referring to the emotions that were chosen for the Portuguese answering system. The participants suggested some changes in the answering method and in the specification of some emotions. Thus, it was decided to name the emotions, instead of using the adjectives referring to those who feel them. Therefore, the Portuguese names given to the emotions were *tristeza* (sadness), *raiva* (anger), *medo* (fear), *felicidade* (happiness), *surpresa* (surprise), *nojo* (disgust), *neutro* (neutral), *calmo* (calm) and *outro* (other).

### 2.3 Procedure

The photographs were digitalized beforehand and randomised with the Software SuperLab, version 4.0, and showed to the participants one-by-one on a 15-inch computer screen, without a time limit and force-choice. However, to help focus attention and avoid other interferences, the participants were instructed to press the key of the corresponding emotion as fast as they could. Besides the six basic emotions, the participants had a key for “calm”, another for “neutral” and also the option “other”, totalizing nine possible answers. The photographs were presented continuously without any kind of feedback.

### 2.4 Statistical analysis

Data were analyzed utilizing the using Statistica (version 8) software on a PC computer and the interactive calculation tool for chi-square of Preacher (2001). All calculations were made using the Chi-square test. Statistical significance was considered at  $p < 0.05$ . All data are reported as mean (M) and standard deviation (SD).

## 3. Results

Because we were only interested in the basic emotions, we did not analyse the results for calm and neutral. The mean of the correct answers of the Portuguese for each basic emotion studied (happiness, surprise, sadness, fear,

disgust, and anger) was calculated and compared with the accuracy rate of the Americans reported by Tottenham et al. (2009) The results are presented in Table 1.

**Table 1.** Accuracy rates of correct answers for happiness, surprise, sadness, fear, disgust, and anger in Portuguese and Americans using NimStim

EMOTION	Portuguese M(SD)	American M(SD)	Chi-square	p value
HAPPINESS	83.64 (16.91)	92 (7.33)	0.40	0.53
SURPRISE	78.91 (2.78)	71 (11.50)	0.42	0.52
SADNESS	59.08 (21.17)	71.50 (18.50)	1.18	0.28
FEAR	42.14 (19.23)	60.00 (16.50)	3.12	0.08
DISGUST	68.14 (28.71)	89.50 (22)	2.89	0.09
ANGER	73.73 (16.40)	87 (24.50)	1.10	0.30

*Note:* M (SD), Mean  $\pm$ Standard deviation

No significant differences were found on the accuracy rates for the basic emotions in Portuguese and Americans. In spite of this, Portuguese accuracy rates for Happiness, Sadness, Fear, Disgust, and Anger were lower than for Americans. In contrast, Portuguese accuracy rate for Surprise was higher than for Americans. Moreover, the Portuguese accuracy rate is above chance level for all emotions except for Fear.

The ability of recognition of the emotions by Portuguese followed the order: happiness > surprise > anger > disgust > sadness > fear while for Americans the order was happiness > disgust > anger > sadness > surprise > fear.

#### 4. Discussion

In this study the performance of Portuguese in the recognition of NimStim photographs set were compared with data published in the literature for similar experiments performed with Americans to find out if the ability of Portuguese to identify facial expressions was (or not) similar to the Americans. To our knowledge it is also the first study using NimStim data set in a Portuguese sample.

The results showed that the performance of Portuguese is not significantly different from the Americans for all the emotions studied, which is consistent with previous findings concerning the universality of recognition of facially expressed emotions.

Also, Portuguese showed an accuracy rate above chance level for all emotions with exception for Fear. This finding leads us to the necessity of studying the

psychometrics characteristics of NimStim applied to Portuguese population.

The lower result of Portuguese in the accuracy of Fear could also not be dissociated from the results obtained for Surprise (the only emotion in which Portuguese have an accuracy rate above the Americans). Thus, it seems that the facial expression of Surprise and Fear are object of confusion by the Portuguese sample and, also, that part of the photography's of Fear were confused with Surprise by Portuguese. This confusion between these two emotions were also found in previous studies<sup>[3,12]</sup>.

It is common to Portuguese and Americans that Happiness is the easiest emotion to recognize while Fear is the more difficult one as found in previous research<sup>[15]</sup>.

We also observed small differences between Portuguese and Americans in what concerns the recognition of facial expressions other than surprise. The ability of recognition of the emotions by Portuguese followed the order: surprise > anger > disgust > sadness while for Americans the order was disgust > anger > sadness > surprise. That may be explained taking by Portuguese been focused on facial different facial cues than Americans. This explanation is in accordance with the results found in previous study showing that both Americans and the Japanese tend to value different facial cues in the recognition of facial expressions<sup>[20]</sup>.

It was also observed that Portuguese present an accuracy rate for all basic emotions lower than Americans with the only exception of Surprise above mentioned. This difference between both populations cannot be attributed to age or gender of the participants because, as described in the Material and Methods Section, the Portuguese sample was matched to the sample used by Tottenham et al. (2009) in what concerns age and gender. One putative explanation to the differences observed is the vertical schooling. Portuguese participants were a large and heterogeneous sample in regarding the vertical schooling, but there is not possible to know if our sample matched the American one for the factor vertical schooling.

Another possible explanation to justify the lower results of Portuguese as compared with Americans is related to the methodology used. In our study, the instruction to the participants to answer as quickly as possible was introduced while in the original study this statement did not exist. It is possible that the introduction of this statement in our study has influenced the recognition accuracy of the Portuguese participants.

#### Limitations and future researches

A limitation of the present research is concerned with

the lack of inclusion of the register of ethnicity of the participants. As the Portuguese sample included different ethnicity, the introduction of the register of ethnicity would allow us to analyse the influence of the ethnicity of stimulus on the recognition of facial expressions. This variable will be included in future research.

In future studies it would also be useful to investigate if the introduction of the instruction to participants to respond as fast as they could is responsible or not for downward the accuracy. Moreover, it would also be interesting to compare the Portuguese and Americans abilities to recognise basic emotions facially expressed using Portuguese stimulus or a mixed database of Portuguese and American stimulus and also using spontaneously (and not posed) images of Americans.

## 5. Conclusion

The ability of the Portuguese to identify basic expressions using NimStim data set was similar to the Americans one. In both samples, Happiness was the easiest emotion recognized and Fear the most difficult. The results also highlighted cultural differences and suggested the necessity of studying the psychometric characteristic of Nimstim when applied in Portuguese.

## References

- [1] Biehl, M., Matsumoto, D., Ekman, P., Hearn, V., Heider, K., Kudoh, T., et al.. Matsumoto and Ekman's Japanese and Caucasian Facial Expressions of Emotion (JACFEE): Reliability Data and Cross-National Differences. *Journal of Nonverbal Behavior*, 1997, 21: 3-21.  
DOI: 10.1023/A:1024902500935
- [2] Ekman, P.. Universal and cultural differences in facial expressions of emotions. In J. Cole (Ed.), *Nebraska symposium on motivation*. Lincoln: University of Nebraska Press, 1972: 207-283.
- [3] Ekman, P., Friesen, W. V., O'Sullivan, M., Chan, A., Diacoyanni-Tarlatzis, I., Heider, K., et al.. Universals and cultural differences in the judgments of facial expressions of emotion. *Journal of Personality & Social Psychology*, 1987, 53(4): 712-717.  
DOI: 10.1037/0022-3514.53.4.712
- [4] Ekman, P., Sorensen, E. R., & Friesen, W. V.. Pan-cultural elements in facial displays of emotions. *Science*, 1969, 164: 86-88.  
DOI: 10.1126/science.164.3875.86
- [5] Elfenbein, H. A., & Ambady, N. A.. On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin*, 2002, 128: 203-235.  
DOI: 10.1037/0033-2909.128.2.203
- [6] Elfenbein, H. A., & Ambady, N. A.. When familiarity breeds accuracy: Cultural exposure and facial emotion recognition. *Journal of Personality and Social Psychology*, 2003, 85: 276-290.  
DOI: 10.1037//0022-3514.85.2.276
- [7] Elfenbein, H. A., Mandal, M. K., Ambady, N. A., Harizuka, S., & Kumar, S.. Hemifacial differences in the in-group advantage in emotion recognition. *Cognition and Emotion*, 2004, 18: 613-629.  
DOI: 10.1016/j.jesp.2005.10.006
- [8] Izard, C. E.. *The face of emotion*. New York: Apple-ton-Century-Crofts, 1971.
- [9] Izard, C. E.. Innate and universal facial expressions: Evidence from development and cross-cultural research. *Psychological Bulletin*, 1994, 115, 288-299.  
DOI: 10.1037/0033-2909.115.2.288
- [10] Matsumoto, D., Olive, A., & Willingham, B.. Is There an Ingroup Advantage in Recognizing Spontaneously Expressed Emotions? *Journal of Nonverbal Behavior*, 2009, 33 (3): 181-191.  
DOI: /10.1007/s10919-009-0068-z
- [11] Matsumoto, D.. Culture and Emotion. In D. Matsumoto (Ed.), *The handbook of culture and psychology* (pp. 171-194). New York: Oxford University Press, 2001.
- [12] Matsumoto, D., & Ekman, P.. American-Japanese cultural differences in intensity ratings of facial expressions of emotion. *Motivation & Emotion*, 1989, 13(2): 143-157.  
DOI: 10.1007/BF00992959
- [13] Matsumoto, D., & Willingham, B.. Spontaneous Facial Expressions of Emotion of Congenitally and Non-Congenitally Blind Individuals. *Journal of Personality and Social Psychology*, 2009, 96(1): 1-10.  
DOI: 10.1037/a0014037
- [14] Matsumoto, D., Keltner, D., Shiota, M. N., Frank, M. G., & O'Sullivan, M.. What's in a face? Facial expressions as signals of discrete emotions. In M. Lewis, J. M. Haviland & L. Feldman Barrett (Eds.), *Handbook of emotions*. New York: Guilford Press, 2008: 211-234.
- [15] Montagne, B., Kessels, R.P., De Haan, E.H., Perrett, D.I.. The Emotion Recognition Task: a paradigm to measure the perception of facial emotional expressions at different intensities. *Perceptual and motor skills*, 2007, 104(2): 589-98.  
DOI: 10.2466/PMS.104.2.589-598
- [16] Preacher, K. J.. Calculation for the chi-square test: An interactive calculation tool for chi-square tests of goodness of fit and independence [Computer software], 2001. Available from:

- <http://quantpsy.org>
- [17] Shioiri, T., Someya, T., Helmeste, D. & Tang, S.W.. Misinterpretation of facial expression: a cross-cultural study. *Psychiatry and Clinical Neurosciences*, 1999, 53(1): 45-50.
- [18] Tottenham, N., Tanaka, J., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., ..., Nelson, C. A.. The Nim-Stim set of facial expressions: judgments from untrained research participants. *Psychiatry Research*, 2009, 168: 242-249.  
DOI: 10.1016/j.psychres.2008.05.006
- [19] Treese, A. -C., Brinkmann, M., & Johansson, M.. Picture database of emotional facial expressions, 2003, Report No 87. Retrieved from Saarland University Website:  
<http://psydok.sulb.uni-saarland.de/volltexte/2003/87/>
- [20] Yuki, M., Maddux, W. W., & Masuda, T.. Are the windows to the soul the same in the East and West? Cultural differences in using the eyes and mouth as cues to recognize emotions in Japan and the United States. *Journal of Experimental Social Psychology*, 2007, 43: 303-311.  
DOI: 10.1016/j.jesp.2006.02.004