

## Education and the Attribution of Emotion to Facial Expressions

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### Abstract

Certain facial expressions have been proposed to be signals evolved to communicate a single specific emotion. Evidence to support this view is based primarily on university-educated Western adults. In the current study ( $N=96$ ), university-educated and non-university-educated Americans were asked to label purported facial expressions of happiness, sadness, anger, fear, surprise, and disgust. Participants with no university education were significantly less likely to label the "fear face" as *scared* or the "disgust face" as *disgusted*, but more likely to label the "anger face" as *angry* and the "sad face" as *sad*. Education was also related to overall use of *disgusted* and *angry* – an effect that might help explain differences in labeling faces.

**Keywords:** education, recognition, facial expression, universality, emotion

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### Introduction

The ability of humans to both produce and recognize facial expressions as signals for basic emotions is an evolutionary adaptation – or so say important emotion theorists (e.g. Ekman & Cordaro, 2011; Ekman & Friesen, 1971; Izard, 1971, 2011). Indeed, a website organized by a leading emotion researcher, David Matsumoto, states, "Research has documented the existence of seven universally expressed and recognized facial expressions of emotion: joy, sadness, fear, surprise, anger, contempt and disgust... the impact of this finding is immense. It means that all people – regardless of race, culture, ethnicity, age, gender or religion – express these emotions in the face in exactly the same way" (Humintell, July 5, 2013). If all people recognize these facial signals, then education level would be predicted to bear no relation to how much a person matches a facial expression with the predicted emotion. The present study tested that prediction.

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In the majority of studies on facial expressions, as with all psychological studies, the samples are composed of college students (Arnett, 2008; Henrich, Heine, & Norenzayan, 2010). Arnett found that, in 2007, 67% of American samples and 80% of samples from other countries were university undergraduates. Only 30% of Americans have received a college degree (US Census Bureau, 2012); thus, samples comprised of undergraduates are not representative of the general population. In the study of facial expressions, little attention has been given to the relation between education level and recognition of facial expressions.

There are several possible reasons to expect education level to be related to facial expression recognition. First, many with a college degree took an introductory psychology course at some point in their undergraduate career. Most introductory psychology text books include a section on emotions and present so-called facial expressions of basic emotions. Thus, those with a college degree may have received some training in recognizing facial expressions as specific discrete emotions. Second, the ability to select the predicted emotion has been found to change with age (Widen, 2013). One possible explanation for the age effect is education. Developmental changes oftentimes remain as individual differences when age is held constant (Kohlberg, 1981).

Despite widespread claims that facial expressions communicate specific basic emotions universally, cross-cultural research has yielded, on one interpretation, mixed or, on another interpretation, less than supportive evidence. Recognition scores vary with language and culture (Jack, Blais, Scheepers, Schyne, & Caldara, 2009; Kayyal & Russell, in press-a, in press-b; Nelson & Russell, 2013). Unfortunately, cross-cultural studies have not always controlled for educational differences, especially for non-Western cultures.

To our knowledge, only two studies examined the relation of education to emotion recognition from faces. In both, participants with more education were more likely to give the expected label for facial expressions purported to convey basic emotions. Wolfgang and Cohen (1988) showed participants angry, happy, surprised, contemptuous, interested, sad, and neutral facial expressions posed on the basis of Ekman & Friesen's (1971) and Izard's (1971) descriptions of the prototypical facial expressions. University graduates gave the expected label most often (81%), followed by high school graduates (66%), and primary school graduates (43%). Mill, Allik, Realo, and Valk (2009) showed participants photos from the Japanese and American Facial Expressions of Emotion set (JACFEE; Matsumoto & Ekman, 1988) for anger, contempt, disgust, fear, happiness, sadness, and surprise. Participants with more education were more likely to select the expected label for contempt, happiness, sadness, and surprise.

As intriguing as these two studies are, they are not definitive. Age of the participants in different education levels was not specified in Wolfgang and Cohen's (1988) study. There was not an equal number of participants for each education level in Mill et al.'s (2009) study: Those with less education were disproportionately in the youngest (18-30) or oldest age groups (61-84). In both studies, a forced-choice response format for the labeling of the emotions was used, but other research has shown that a "none of the above" option helps avoid some response artifacts (Frank & Stennett, 2001; Garcia-Perez, 1993). It was not clear if education had a general effect or one related to only certain facial expressions.

Wolfgang and Cohen (1988) did not report any sex differences in labeling. But Mill et al. (2009) did: They found that women gave the expected label significantly more often than men for disgust, anger, sadness, happiness, and contempt facial expressions. Several other studies have found a female superiority in emotion recognition (Hall, 1978; Hall & Matsumoto, 2004; Hampson, van Anders, & Mullin, 2006). In a meta-analysis, Hall (1978) found that, in 102 of 136 studies, women were more likely to use the expected label for facial expressions than were men. Hampson et al. (2006) found that women produced the expected label significantly faster than men, particularly for disgust and anger facial expressions. The interaction between sex and education level, however, has not been explored.

In the present study, participants with a college degree were compared to those with no college education who were matched for age. By providing an age-matched sample, the possibility that differences in labeling are due solely to cohort differences can be ruled out. Faces for six basic emotions (happiness, sadness, anger, fear, surprise, disgust) were included. For each facial expression, the participant selected from a list (*angry, disgusted, happy, sad, scared, surprised, and none of the above*) the one word that best described the emotion conveyed.

## **Method**

### *Participants*

Participants were 96 adults between the ages of 19 and 69 years. The mean age of participants with no college education was 35.5 years ( $N=48$ ,  $SD=13.1$  years; range = 19-69 years; 8 had some high school education, 39 had a high school diploma or a GED) and with a college degree was 33.9 years ( $N=48$ ,  $SD=11.0$  years; range = 19-64 years; 35 had a Bachelor's Degree, 10 had a Master's Degree, 3 had a Doctorate Degree) as indicated by self-report. Participants with "some college education" or an Associate's Degree (2 years) were not included in the

sample. Each group was evenly divided by sex. The sample was 64.5% Caucasian, 11.5% Hispanic, 10.4% African American, 5.2% Asian, 3.1% Middle Eastern, and 1.0% American Indian. The remaining percentage did not indicate their ethnicity. Participants were recruited in public spaces in Boston.

### *Materials*

Expressions posed by 12 different Caucasian posers from the JACFEE (Matsumoto & Ekman, 1988) set were presented to the participants in black and white 4" x 6" photographs. A male and female poser displayed each of six facial expressions: happiness, sadness, anger, fear, surprise, and disgust.

### *Procedure*

There were 6 differently ordered versions of the survey. Each page contained only one of the 12 facial expressions. Participants indicated how the person in the photograph felt by selecting a label from the accompanying list (*angry, disgusted, happy, sad, scared, surprised, or none of the above*).

### *Scoring*

Selection of the label specified by Matsumoto and Ekman (1988) was scored as correct; otherwise, incorrect.

## **Results**

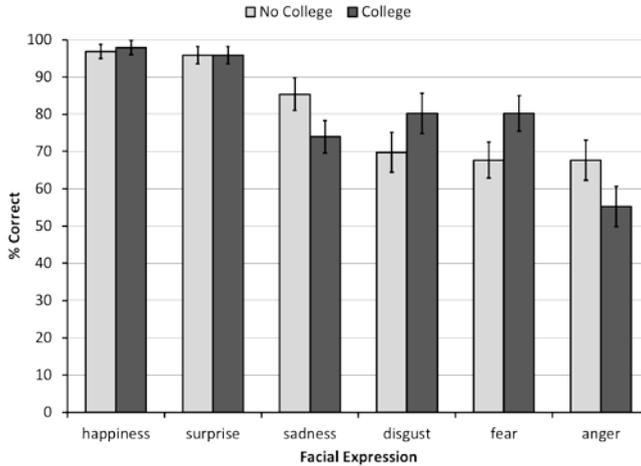
### *Education Level and Sex*

The first question was whether those with a college degree selected the expected label more than those with no college education. In a mixed-design ANOVA ( $\alpha=.05$ ), education-level (2 levels: no college, college degree) and participant sex (2 levels: male, female) were between-subject factors; facial expression (six levels: happiness, sadness, anger, fear, surprise, disgust) was a within-subject factor. The dependent variable was whether or not each face was labeled correctly (range = 0-2).

The effects for facial expression and education level are illustrated in Figure 1. The main effect for facial expressions was significant,  $F(5,460)=26.29$ ,  $p < 0.001$ ,

partial  $\eta^2=.22$ . The rank order (from highest to lowest) was: happiness, surprise, sadness, disgust, fear, and anger.

Figure 1. *Education Level Affected Correct Labeling of Facial Expressions*



*Note.* Those with a college degree were more likely to label disgust ( $p=.08$ ) and fear ( $p=.04$ ) correctly than those with no college; those with no college were more likely to label sadness ( $p=.06$ ) and anger ( $p=.04$ ) faces correctly than those with a college degree.

Although the main effect for education level was not significant,  $F(1, 92)=.00$ , the interaction between education level and facial expression was significant,  $F(5,460)=3.80$ ,  $p<.01$ , partial  $\eta^2=.04$ . Least Significant Difference (LSD) comparison showed that, for anger ( $p<.05$ ) and sadness ( $p=.06$ ), participants with no college education were more likely to select the correct label than were those with a college degree. For fear ( $p<.05$ ) and disgust ( $p=.08$ ), the pattern was reversed.

The main effect for sex was also significant,  $F(1,92)=4.05$ ,  $p<.05$ , partial  $\eta^2=.04$ . Females (.80) selected the correct label significantly more than did males (.71). There were no significant interactions involving sex.

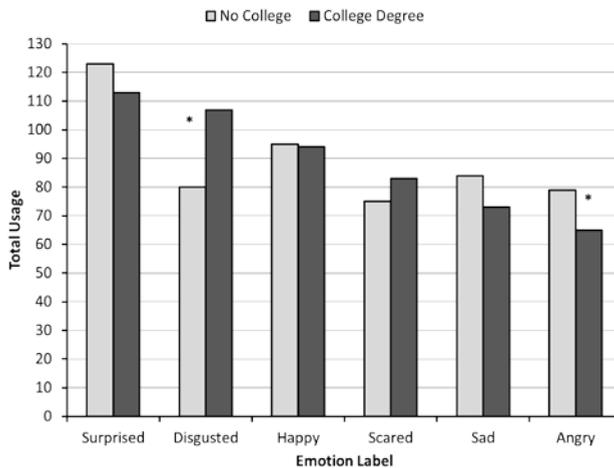
#### *Education Level and Total Use of Emotion Labels*

Education level, but not sex, also affected participants' total use of some labels. For this analysis, total label use (not correct labeling) was the measure of interest. In a MANOVA, education-level (2 levels: no college, college degree) and

participant sex (2 levels: male, female) were between-subject factors; and emotion label (*happy, sad, angry, scared, surprised, disgusted*) was a within-subject factor. The dependent variable was the total number times each label was used (range = 0-7). The main and interactive effects for sex were not significant.

The effects for emotion label and education level are presented in Figure 2. The main effect for emotion label was significant, Wilks  $F(5,88)=14.55$ ,  $p<.001$ . The rank order (from highest to lowest) was: *happy, surprised, disgusted, scared, sad*, and *angry*. The interaction between education level and emotion label was also significant,  $F(5,88)=2.43$ ,  $p<.05$ . LSD comparisons showed that participants with a college degree were significantly ( $p<.001$ ) more likely to select *disgusted* than were those with no college. Participants with no college education were significantly ( $p<.05$ ) more likely to select *angry* than were those with a college degree.

Figure 2. Frequency of Emotion Label Use for Participants with no College Degree vs. those with a Degree



Note. Participants differed significantly for *disgusted* and *angry*.

In order to better understand the differences in the use of *angry* and *disgusted* between participants with different levels of education, a confusion matrix of all the responses for each facial expression was created for each group (Table 1). In addition to the differences between groups' correct responses for these labels (Figure 1), participants with a college degree were significantly more likely to use *disgusted* for the anger face than were those with no college,  $t(94)=2.04$ ,  $p<.05$ ; the

same pattern was present, but not significant, for the sadness face ( $p>.05$ ). There were no significant differences in incorrect uses of *anger* between the two groups.

Table 1. *Frequency of Forced Choice Responses for Each Facial Expression*

Response Label	Facial Expression						Total
	Happiness	Surprise	Sadness	Fear	Disgust	Anger	
<i>No college</i>							
<i>Happy</i>	<b>93</b>	0	1	0	0	1	95
<i>Surprised</i>	0	<b>92</b>	1	24	3	3	123
<i>Sad</i>	0	0	<b>82</b>	0	0	2	84
<i>Scared</i>	1	2	6	<b>65</b>	1	0	75
<i>Disgusted</i>	0	1	1	1	<b>67</b>	10	80
<i>Angry</i>	1	0	1	0	12	<b>65</b>	79
<i>None</i>	1	1	4	6	13	15	40
Total	96	96	96	96	96	96	
<i>College degree</i>							
<i>Happy</i>	<b>94</b>	0	0	0	0	0	94
<i>Surprised</i>	1	<b>92</b>	1	14	3	2	113
<i>Sad</i>	0	0	<b>71</b>	0	0	2	73
<i>Scared</i>	0	1	5	<b>77</b>	0	0	83
<i>Disgusted</i>	0	2	5	3	<b>77</b>	20	107
<i>Angry</i>	0	0	2	0	10	<b>53</b>	65
<i>None</i>	1	1	12	2	6	19	41
Total	96	96	96	96	96	96	

Note. **Bold** numbers on the diagonal are correct responses. Maximum for each cell is 96. *N* for each group was 48.

## Discussion

There was a significant difference in the way people with a college degree and those with no college education labeled facial expressions. This general result was consistent with the findings of Wolfgang and Cohen (1988) and Mill et al. (2009). All the same, our results differed in the details from previous findings. In our study, participants with a college degree selected the expected label for fear and disgust significantly more often than participants with no college. (College education in Wolfgang and Cohen's study showed a main effect of more correct scores with more education, and in Mill et al.'s study education was correlated with the selection of the expected label for contempt, happy, sad, and surprised expressions.)

On the other hand, our results were at odds with Wolfgang and Cohen's and Mill et al.'s in that our participants with no college education selected the expected label for sadness and anger significantly *more* often than did those with a college degree.

Our result with the disgust face was particularly intriguing. Wolfgang and Cohen (1988) did not include disgust facial expressions; Mill et al. (2009) found no effect for education level for disgust expressions. Of the so-called basic facial expressions, disgust is least likely to be labeled correctly (Haidt & Keltner, 1999; Widen, Christy, Hewett, & Russell, 2011; Widen & Russell, 2008a, 2013; see also Nelson & Russell, 2013, Table 2). Children's recognition of the disgust facial expression develops only gradually (Gagnon, Gosselin, Hudon-ven der Buhs, Larocque, & Milliard, 2010; Widen & Russell, 2013). Thus, the present results show that it is possible that this age difference is not simply a result of getting older, but also of the education children receive.

Our results with the total (both correct and incorrect) uses of each label provide a possible explanation for the relation of education and correct responses. The meaning of the words *sadness* and *anger* are broader for preschoolers than they are for adults (university undergraduates); indeed, children use the labels *sad* and *angry* for most negative emotion stimuli (Widen & Russell, 2004, 2008a, 2008b, 2010; Widen, 2013). Similarly, participants with no college education used *sad* and *angry* more frequently than did those with a college education, who, in turn, used *disgusted* and *afraid* more (although differences were significant only for *angry* and *disgusted*). Thus, both correct and incorrect responses depend to some extent on the tendency to use certain labels. Nabi (2002) showed that undergraduates' implicit definition of *disgusted* included both disgust and anger. In addition, colloquially, people sometimes use the word *disgusted* to mean *outraged* or *appalled* (Bloom, 2004).

These findings raise questions about findings from prior studies that compared cultures but did not take education level into account (Ekman, Sorenson, & Friesen, 1969). Differences in education level were confounded with differences in culture and thus might have exaggerated differences between cultures.

The differences found in this study on education level and the sex of the participant raise questions about the common assumption that facial expressions are universally and easily recognized signals of specific emotions. Rather than thinking of facial expressions as signals, it might be better to think of facial expressions as cues to emotion which need to be interpreted within the observer's context, with interpretation varying with the education and sex of the observer.

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