



## The NimStim set of facial expressions: Judgments from untrained research participants

Nim Tottenham<sup>a,\*</sup>, James W. Tanaka<sup>b</sup>, Andrew C. Leon<sup>c</sup>, Thomas McCarry<sup>a</sup>, Marcella Nurse<sup>a</sup>, Todd A. Hare<sup>a</sup>, David J. Marcus<sup>d</sup>, Alissa Westerlund<sup>e</sup>, BJ Casey<sup>a</sup>, Charles Nelson<sup>e</sup>

<sup>a</sup> Sackler Institute for Developmental Psychobiology, Weill Cornell Medical College, New York, NY, USA

<sup>b</sup> Department of Psychology, University of Victoria, Victoria, British Columbia, Canada

<sup>c</sup> Department of Psychiatry, Weill Cornell Medical College, New York, NY, USA

<sup>d</sup> Children's National Medical Center, Rockville, MD, USA

<sup>e</sup> Developmental Medicine Center, Children's Hospital Boston/Harvard Medical School, Boston, MA, USA

### ARTICLE INFO

#### Article history:

Received 14 May 2007

Received in revised form 24 August 2007

Accepted 4 May 2008

#### Keywords:

Face  
Expression  
Stimulus set  
Emotion  
Multiracial  
Validity  
Reliability

### ABSTRACT

A set of face stimuli called the NimStim Set of Facial Expressions is described. The goal in creating this set was to provide facial expressions that untrained individuals, characteristic of research participants, would recognize. This set is large in number, multiracial, and available to the scientific community online. The results of psychometric evaluations of these stimuli are presented. The results lend empirical support for the validity and reliability of this set of facial expressions as determined by accurate identification of expressions and high intra-participant agreement across two testing sessions, respectively.

© 2008 Elsevier Ireland Ltd. All rights reserved.

### 1. Introduction

The literature on human social and emotional behavior is rich with studies of face processing. An online search in databases like PubMed for “face perception” or “face processing” to date results in over 7000 relevant papers. A similar search for “facial expression” results in over 5000 hits. Integral to these studies is the availability of valid and reliable face stimuli. This paper describes a set of face stimuli (the NimStim Set of Facial Expressions – available to the scientific community at <http://www.macbrain.org/resources.htm>) and reports validity and reliability for this set based on ratings from healthy, adult participants.

Facial expressions and their interpretation are a topic of interest to researchers because of the links between emotional experience and facial expression. It has been argued that expressions of facial emotion have communicative value (Darwin, 1872) with phylogenetic roots (Izard, 1971). Both the production (Ekman and Friesen, 1978) and the interpretation of facial expressions (Schlossberg, 1954; Russell and Bullock, 1985) have been examined empirically. Previous research using existing sets (Ekman

and Friesen, 1976) has established much of what is known about face processing. However, the parameters of existing sets may not always satisfy the objectives of the experiment (Erwin et al., 1992). For example, the number of stimuli may be too few (Winston et al., 2002), the stimulus set may not have enough racial or ethnic diversity, or there might not be an appropriate comparison or baseline expression (Phillips et al., 1998). Issues like these have motivated researchers to create their own stimuli (Hart et al., 2000; Phelps et al., 2000; Gur et al., 2002; Batty and Taylor, 2003; Phelps et al., 2003; Tanaka et al., 2004). The goal of creating the NimStim Set of Facial Expressions was to provide a set of facial expressions that address these issues.

A number of features of the set are advantageous for researchers who study face expression processing. Perhaps the most important is the racial diversity of the actors. Studies often show that the race or ethnicity of a model impacts face processing both behaviorally (Elfenbein and Ambady, 2002; Herrmann et al., 2007) and in terms of the underlying neurobiology of face processing (Hart et al., 2000; Phelps et al., 2000; Golby et al., 2001; Lieberman et al., 2005). This modulation by race or ethnicity is not identified for all populations (Beaupre and Hess, 2005) and may be driven by experience (Elfenbein and Ambady, 2003) and bias (Phelps et al., 2000; Hugenberg and Bodenhausen, 2003).

To address such findings, face sets have been developed that consist of models from various backgrounds. For example, the JACFEE

\* Corresponding author. Sackler Institute for Developmental Psychobiology, Weill Cornell Medical College, 1300 York Avenue, Box #140, New York, NY 10021, USA. Tel.: +1 212 746 5830; fax: +1 212 746 5755.

E-mail address: [nlt2002@med.cornell.edu](mailto:nlt2002@med.cornell.edu) (N. Tottenham).

set (Ekman and Matsumoto, 1993–2004) consists of Japanese and Caucasian models, Mandal's (1987) set consists of Indian models, Mandal et al.'s (2001) set consists of Japanese models, the Montreal Set of Facial Displays of Emotion (Beaupre et al., 2000) consists of French Canadian, Chinese, and sub-Saharan African models, and Wang and Markham's (1999) set consists of Chinese models. Unlike these other sets, the NimStim set provides one uniform set of Asian-American, African-American, European-American, and Latino-American actors, all photographed under identical conditions. Additionally, because these actors all live in the same metropolitan city within the U.S., the subtle differences that accompany expressions when posed by individuals from different countries are minimized (Ekman and Friesen, 1969; Matsumoto et al., 2005). The NimStim set has attributes, described below, that are not typically found in other sets that include models from non-European populations.

There are four distinguishing attributes of the set that build on previously established sets. First, the NimStim set is available in color, and it contains a large number of stimuli and a large variety of facial expressions. Whereas most sets contain roughly 100 or fewer stimuli (Mandal, 1987; Ekman and Matsumoto, 1993–2004; Wang and Markham, 1999; Mandal et al., 2001), the NimStim set contains 672, consisting of 43 professional actors, each modeling 16 different facial poses, including different examples of happy, sad, disgusted, fearful, angry, surprised, neutral, and calm. Secondly, a neutral expression is included in this set. The neutral expression is sometimes included in other facial expression sets (Ekman and Friesen, 1976; Erwin et al., 1992; Ekman and Matsumoto, 1993–2004), but is often omitted, particularly in sets that include models from different racial and ethnic backgrounds (Mandal, 1987; Wang and Markham, 1999; Beaupre et al., 2000; Mandal et al., 2001). The inclusion of the neutral expression is important since neutral is often a comparison condition, particularly in neuroimaging studies (Breiter et al., 1996; Thomas et al., 2001). Thirdly, the NimStim set contains open- and closed-mouth versions of each expression, which can be useful to experimentally control for perceptual differences (e.g., toothiness) that can vary from one expression to another, as this featural difference may bias responses (Kestenbaum and Nelson, 1990). Having closed- and open-mouth versions also facilitates morphing between various expressions by reducing blending artifacts. Lastly, since positively valenced faces are generally lower in arousal than negatively valenced faces and can present an arousal/valence confound, this set includes three degrees of happy faces (e.g., closed-mouth, open-mouth, and high arousal/exuberant).

A final distinguishing feature of this set is the inclusion of a calm face. Studies examining the perception of facial expressions often use neutral faces as the comparison face (Breiter et al., 1996; Vuilleumier et al., 2001). However, there is evidence to suggest that neutral faces may not always be perceived as emotionally neutral (Donegan et al., 2003; Somerville et al., 2004; Lidaka et al., 2005), especially for children (Thomas et al., 2001; Lobaugh et al., 2006). Researchers have artificially generated other comparison faces (i.e., 25% happy) to address this concern (Phillips et al., 1997). Within the NimStim Set, a calm expression category is provided, which is perceptually similar to neutral, but may be perceived as having a less negative valence. Here we provide data validating the use of the calm face.

Validation of the entire set was accomplished by asking participants to label each stimulus. A different method of rating face stimuli involves having highly trained raters use facial action units to make judgments about the expressions (Ekman and Friesen, 1977; Ekman and Friesen, 1978). This method is very useful for establishing the uniformity of expression exemplars. The merit of the method used in this article is that the ratings were obtained from untrained volunteers, who are characteristic of those in face expression processing studies. In other words, the approach taken in this study to establish whether a certain expression was perceived as the intended expression was to measure concordance between the subjects' labels and the intended expressions posed by the actors (the validity measure) as well as the intra-participant test–retest reliability. We hypothesized that the participants'

judgments of these stimuli would provide empirical support for the reliability and validity of this new set of facial expressions.

## 2. Method

### 2.1. Participants

Data were collected from two groups of participants, producing a total *N* of 81 participants. The first group included 47 undergraduate students from a liberal arts college located in the Midwestern United States. Mean age was 19.4 years (18–22, S.D. = 1.2), and the majority (39/47) of these respondents were female. The participants received course credit for their participation in the study. Based on the participant pool data, it was estimated that 81% (38/47) were European-American, 6% (3/47) were African-American, 9% (4/47) were Asian-American, and 4% (2/47) were Hispanic-American. Only validity ratings, not reliability ratings, were obtained from this first group of participants. In order to increase the number of participants for the validity ratings, in particular, male participants, we recruited a second group of participants, which comprised 34 volunteers from the New York Metropolitan area. Mean age of this group was 25.8 years (19–35, S.D. = 4.1), and 35% (12/34) were female and 65% (22/34) were male. The participants were monetarily compensated for their time. Fifty-nine percent (20/34) were European-American, 18% (6/34) were African-American, 6% (2/34) were Asian-American, 6% (2/34) were Latino-American, and 12% (4/34) identified as a non-listed race or ethnicity. Three measures were obtained from this second group of participants: validity, test–retest reliability, and calm vs. neutral validity.

### 2.2. Stimuli

Stimuli were images from the NimStim Set of Facial Expressions (672 images; <http://www.macbrain.org/resources.htm>), which consisted of naturally posed photographs (e.g., with hair, make-up) of 43 professional actors (18 female, 25 male; 21 years old–30 years old) in New York City. Actors were African- (*N* = 10), Asian- (*N* = 6), European- (*N* = 25), and Latino-American (*N* = 2). Actors were instructed to pose eight expressions: happy, sad, angry, fearful, surprised, disgusted, neutral, and calm (see Fig. 1). For each expression, separate open- and closed-mouth versions were posed, except for surprise, which were only posed with an open mouth<sup>1</sup>. Negatively valenced faces typically differ from faces like happy in terms of valence, but also are higher in arousal level. Therefore, three versions of happy were obtained (closed-mouth, open-mouth, and high arousal open-mouth/exuberant). All stimuli were included in this validation paradigm regardless of the quality of acting.

Actors were instructed to pose a particular expression (e.g., “Make a happy face”) and produce the facial expression as they saw fit (Mandal, 1987; Mandal et al., 2001). Once one version of the facial expression (e.g., closed mouth) was created and photographed, the other version (e.g., open mouth) was prompted and photographed. To create the calm faces, actors were instructed to transfigure their neutral face into a more relaxed one, as if they were engaged in a calming activity or otherwise pleasantly preoccupied. Therefore, the calm faces were essentially neutral faces with less overall muscle tension in the face. Actors were paid for their time.

### 2.3. Evaluation procedure

#### 2.3.1. Validity

Participants were seated approximately 53 cm from the computer. All 672 stimuli were presented on a Macintosh computer using the Psyscope experimental software package (Cohen et al., 1993). Images

<sup>1</sup> A closed-mouth version of surprise is modeled by two of the actors.

متن کامل مقاله

دریافت فوری ←

**ISI**Articles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات