*Behavior Research Methods, Instruments, & Computers*
*2004, 36 (4), 630-633*

# A lifespan database of adult facial stimuli

MEREDITH MINEAR
*University of Michigan, Ann Arbor, Michigan*

and

DENISE C. PARK
*University of Illinois at Urbana-Champaign, Urbana, Illinois*

Faces constitute a unique and widely used category of stimuli. In spite of their importance, there are few collections of faces for use in research, none of which adequately represent the different ages of faces across the lifespan. This lack of a range of ages has limited the majority of researchers to using predominantly young faces as stimuli even when their hypotheses concern both young and old participants. We describe a database of 575 individual faces ranging from ages 18 to 93. Our database was developed to be more representative of age groups across the lifespan, with a special emphasis on recruiting older adults. The resulting database has faces of 218 adults age 18–29, 76 adults age 30–49, 123 adults age 50–69, and 158 adults age 70 and older. These faces may be acquired for research purposes from http://agingmind.cns.uiuc.edu/facedb/. This will allow researchers interested in using facial stimuli access to a wider age range of adult faces than has previously been available.

A recent survey of the psychological literature using PsycINFO found that in the past 3 years, over 200 studies have been conducted with images of faces used as stimuli. These studies covered a wide array of research areas, including perception, attention, memory, social reasoning, emotion, infant and adult development, and neuropsychology. This should come as no surprise. Faces are a unique category of objects, in that all sighted individuals have much experience with them and yet find them difficult to verbalize. Although debate continues, much evidence suggests that faces, in contrast to other visual objects, are uniquely processed in specific sites in the fusiform gyrus (Gross, Rocha-Miranda, & Bender, 1972; Haxby et al., 1994; Kanwisher, 2000; Kanwisher, McDermott, & Chun, 1997; Puce, Allison, Gore, & McCarthy, 1995), suggesting that certain neuroanatomical sites are specialized for processing faces or stimuli with similar configural details.

When contrasts are found in memory for meaningful pictures in old and young adults, the behavioral literature dissociates facial memory from memory for other complex pictorial stimuli in old adults. A number of studies have shown that recognition of visual stimuli such as objects and complex scenes shows little to no age-related decline (Park, Puglisi, & Smith, 1986; Park, Puglisi, & Sovacool, 1983; Rybarczyk, Hart, & Harkins, 1987). Faces, however, constitute an exception to this general finding of preserved picture recognition. In comparison with younger adults, older adults are significantly impaired in their recognition of unfamiliar faces (Bartlett, Leslie, Tubbs, & Fulton, 1989; Crook & Larrabee, 1992; Grady et al., 1995; Smith & Winograd, 1978). Moreover, neuroimaging studies of face perception and memory in older and younger adults have found different patterns of frontal and medio-temporal activation in older adults than in young (Grady, 2002; Grady et al., 1994; Grady et al., 1995). Others have reported less differentiation of neural structures in old than in young for faces in the fusiform gyrus (Park, Polk, Park, Minear, & Savage, 2004). However, a confound present in both the behavioral and the neuroimaging studies is that they do not take the age of the faces used as stimuli into account. This is problematic, because a number of studies have shown that the type of face used as a stimulus can influence how well a face is remembered (Bäckman, 1991; Brigham & Barkowitz, 1978; Going & Read, 1974; Golby, Gabrieli, Chiao, & Eberhardt, 2001; Malpass & Kravitz, 1969; Mason, 1986). Faces more similar to the face of the individual studying them are remembered and discriminated better than faces that are different. This is generally thought to be due to the amount of exposure an individual has had to certain classes of faces, the idea being that people typically see faces similar to their own on a daily basis. This effect has been found for race (Malpass & Kravitz, 1969), gender (Going & Read, 1974), and age (Bäckman, 1991; Mason, 1986).

A recent neuroimaging study suggests that these experientially based differences in memory performance

This research was supported by a seed grant to the first author supported by the Roybal Center on Aging and Cognition: Health, Education, and Training (AG11715-10). We thank Kevin Karg, Rob Park, and Anna Savage for their assistance in taking the photographs, and Andy Hebrank for creating the database Web site. We also thank Kara Bopp and Darlene V. Howard for their helpful comments on a previous version of this article. Correspondence concerning this article should be addressed to M. Minear, Washington University, Department of Psychology, Campus Box 1125, St. Louis, MO 63130-4899 (e-mail: minear@umich.edu).

 

correspond to differences in brain activity. Golby, Gabrieli, Chiao, and Eberhardt (2001) investigated the same-race memory advantage using fMRI and found differential activation in face-processing areas of the brain for same-race faces than for different-race faces. Neuroimaging studies of face processing in younger and older adults have not controlled for the age of the faces seen by their young and old participants since the typical mechanism for obtaining sources of pictures is high school yearbooks (Grady, 2002; Grady et al., 1994; Grady, McIntosh, Horwitz, & Rapoport, 2000). Therefore, it is unclear whether differences between older and younger adults may or may not be due in part to experiential differences in processing faces of different ages. Older adults may be at a disadvantage when viewing younger faces, just as individuals of one race are at a disadvantage when asked to remember faces of another race.

A complete understanding of face memory requires that we understand the role of experience in recognizing and remembering different types of faces, keeping in mind evidence that age is an important dimension. There is no easy way at present to secure a range of facial stimuli that vary in age for research projects. Some researchers are openly aware of the possible problems in using a limited age range of faces in studies of age. The authors of a recent study of face recognition in younger and older adults acknowledged in their discussion section that the lack of older faces used as stimuli (75% of the faces shown were age 35 and younger, with the oldest faces age 50 and younger) may have benefited the younger participants and affected their results (Bastin & Van der Linden, 2003).

In a search on the Web, we found that the existing databases of faces fall into two basic categories. The larger category consists of those which contain a large number of images of a small number of people. The ages of these individuals are typically not listed, though they generally appear to be young to middle-aged adults. Examples include the Yale Face Database, which has 165 images of 15 individuals (http://cvc.yale.edu/projects/yalefaces/yalefaces.html); the UMIST Face Database, which consists of 564 images of 20 people (http://images.ee.umist.ac.uk/danny/database.html); and the MIT Face Database, which contains 27 images of 16 different people (ftp://whitechapel.media.mit.umich.edu/pub/images/). Presumably, these databases are designed more for the computational analysis of faces than for behavioral studies of faces, which require larger numbers of faces. The second category of such databases contains larger numbers of individual faces from fewer angles. One of the few examples of such a database is the University of Stirling face database (http://pics.psych.stir.ac.uk/). However, this database too does not list the ages of the faces, and it contains very few individuals identifiably over 50. In a review of a number of studies in which images of faces were used as stimuli, we found that the images used were either photos taken by the experimenters or pictures obtained from popular media sources or high school/college yearbooks. Therefore, to further our own research and that of others, we decided to create a large database of faces with an age range wider than that of any database currently available. In particular, we were especially determined to include adults of age 50 and older in addition to traditional college-aged individuals. To accomplish this in a reasonable amount of time, we planned visits to areas with large numbers of people in the age ranges we were interested in and took digital photographs on the site.

## METHOD

### Participants

The participants consisted of 576 paid volunteers. Their recruitment is detailed in the Procedure section, and their demographic characteristics are described in the Results.

### Procedure

Site visits were arranged with the management of two college student unions, a shopping mall, and two senior citizen festivals in northern Ohio and southern Michigan. At each location, a table with a recruitment banner was set up. The banner read, "Get your picture taken, contribute to science and get paid! We're looking for adults age 18–100. Help the University of Michigan Psychology Department create a face photo database and earn 10 dollars!" The purpose of the visit was explained to all who approached the table and expressed interest. Those who wished to participate were asked to sign both an informed consent document, in which it was explained that the pictures taken were to be used for psychological research, and a legal release form, which permitted the use of the picture of one's face for psychological research. Sex, age, and race/ethnic background were recorded for each participant. The participants' names were not linked to their pictures. After giving informed consent, the participants were then asked to stand in front of a neutral gray background provided by a portable projection screen. Because the space in which to take the photos and the availability of electrical outlets varied greatly from location to location, all photos were taken under natural lighting. Digital photographs were taken with a Kodak DC 3400 zoom 2.0 megapixel digital camera using the flash

**Table 1**
**Total Number of Participants Broken Down by Age Group, Race, and Gender**

| | Age | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 18–29 | | 30–49 | | 50–69 | | 70–93 | |
| Race | Male | Female | Male | Female | Male | Female | Male | Female |
| African-American | 14 | 29 | 7 | 9 | 3 | 12 | 2 | 13 |
| Caucasian | 62 | 65 | 22 | 38 | 23 | 82 | 46 | 97 |
| Other | 38 | 11 | 0 | 0 | 2 | 1 | 0 | 0 |
| Totals | 114 | 105 | 29 | 47 | 28 | 95 | 48 | 110 |

**Table 2**
**Breakdown of Pictures by Facial Expression, Gender, and Race for the 18–29 Age Group**

| | | Race | | |
|---|---|---|---|---|
| Expression | Gender | African-American | Caucasian | Other |
| Happy | Male | 14 | 30 | 40 |
| | Female | 20 | 30 | 9 |
| Neutral | Male | 14 | 62 | 38 |
| | Female | 29 | 65 | 11 |
| Profile | Male | 13 | 43 | 41 |
| | Female | 16 | 34 | 9 |

**Table 3**
**Breakdown of Pictures by Facial Expression, Gender, and Race for the 30–49 Age Group**

| | | Race | | |
|---|---|---|---|---|
| Expression | Gender | African-American | Caucasian | Other |
| Happy | Male | 2 | 5 | 0 |
| | Female | 3 | 9 | 0 |
| Neutral | Male | 7 | 22 | 0 |
| | Female | 9 | 38 | 0 |
| Profile | Male | 2 | 7 | 0 |
| | Female | 3 | 10 | 0 |

and a resolution of 1,760 × 1,168 pixels. One to three pictures were taken of each person. All participants were asked to assume a neutral expression and to look directly into the camera. Additional pictures were taken, depending on time constraints and the willingness of the participant. These were a smiling expression and a right-facing profile. All images were then downloaded to a computer and edited in Adobe Photoshop (Version 6) to produce greater uniformity across pictures taken in different locations. The pictures were resized to a 640 × 480 pixel resolution and saved in bitmap format. The original images in jpeg format were also kept.

**Table 4**
**Breakdown of Pictures by Facial Expression, Gender, and Race for the 50–69 Age Group**

| | | Race | | |
|---|---|---|---|---|
| Expression | Gender | African-American | Caucasian | Other |
| Happy | Male | 2 | 8 | 1 |
| | Female | 5 | 32 | 0 |
| Neutral | Male | 3 | 23 | 2 |
| | Female | 12 | 82 | 1 |
| Profile | Male | 2 | 10 | 1 |
| | Female | 7 | 46 | 1 |

**Table 5**
**Breakdown of Pictures by Facial Expression, Gender, and Race for the 70–93 Age Group**

| | | Race | | |
|---|---|---|---|---|
| Expression | Gender | African-American | Caucasian | Other |
| Happy | Male | 1 | 15 | 0 |
| | Female | 9 | 23 | 0 |
| Neutral | Male | 2 | 46 | 0 |
| | Female | 13 | 97 | 0 |
| Profile | Male | 2 | 21 | 0 |
| | Female | 10 | 30 | 0 |

## RESULTS

Five hundred seventy-six individuals participated in the creation of this database of faces with a total of 1,142 individual images. The breakdown of participants by age, race, and gender can be seen in Table 1. There was a highly successful recruitment of older adults; 281 of the individuals were over 50 years of age, and 148 of these were 70 and older. Although the majority of the participants were Caucasian (76%), there was a significant minority participation, with 89 African-American participants (16%) and the remaining 8% consisting of people of Asian, South Asian, and Hispanic backgrounds. Neutral expression forward-facing pictures were taken of all 576 individuals. A right-facing profile was obtained for 308 participants, and a smiling (happy) expression was obtained for 258 participants. Tables 2–5 provide a detailed breakdown by race and gender of the number of neutral, happy, and profile images available for each age group.

Each photo was given a filename indicating the race, gender, age, and type (neutral, happy, profile) of the face. An Excel spreadsheet was used to create a database of the filenames, with each entry hyperlinked to the corresponding photo. Record fields containing the gender, age, race, and expression of each photo were added to allow for easy sorting of the files by any of these variables. The database can be readily accessed and is available to all researchers by visiting http://agingmind.cns.uiuc.edu/facedb/.

## DISCUSSION

We succeeded in our goal of creating a database of faces with a large number of faces from throughout the adult lifespan. The database is unique in the large number of faces from both younger and older individuals, and it contains faces more representative of those seen in real life as opposed to face stimuli derived from media sources. In creating this collection of digital photographs and making it freely available to the wider research community, we hope to remove a lack of available stimuli as an impediment to using a wide variety of ages when one is studying issues such as face perception and memory. Our stimuli have a wider range of ages than do stimuli derived from the media or high school yearbooks, and they have better resolution. This is especially important for research on aging, because older adults, in comparison with younger adults, may be at a disadvantage when asked to remember young faces (Bäckman, 1991). Future work using these stimuli will be able to distinguish between biological effects of age, which presumably affect all faces equally, and experiential effects, which are based on what sort of faces an individual sees daily.

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(Manuscript received December 31, 2003;
revision accepted for publication May 31, 2004.)