Age-related Differences in Emotion Recognition Ability: Visual and Auditory Modalities

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Emotion recognition is an important aspect of social interaction. Deficits in emotion recognition have been tied to poor social competence, interpersonal functioning, and communication along with a reduced quality of life and inappropriate social behavior. Recent experimental evidence suggests that emotion recognition ability across modalities seems to change in an age-dependent way, with deficits specifically noted for negative emotion recognition. Therefore, the primary purpose of this study is to assess emotion recognition ability in both the visual and auditory modalities in healthy elderly patients versus healthy young patients to test the hypothesis that deficits in emotion recognition ability are age-related and increase with age across visual and auditory modalities. The secondary purpose of this study is to assess valence-specific emotion recognition ability to test the hypothesis that increased deficits for elderly individuals as compared to young healthy subjects occur for negative emotion recognition specifically. We examined the ability to recognize emotion in the auditory and visual modality in two groups of patients: healthy elderly subjects and healthy young subjects. The Montreal Affective Voices task (MAV), the Distorted Tunes task (DTT), the Awareness of Social Inference test (TASIT), and the Baron-Cohen Mind in the Eyes Test (EYES) were used to gauge emotion recognition ability. For the visual tasks (TASIT and EYES), the elderly subjects and young subjects did not have significant differences in performance. In addition, a significant difference was also not found for the DTT, indicating that both populations had intact lower-level auditory processing abilities. Significant differences were found between the two populations on the MAV task in both baseline accuracy and valence-specific performance. These findings suggest that age-related deficits in emotion recognition may be specific to the recognition of auditory emotion.

Introduction

Emotion recognition is an important aspect of social interaction. Individuals who are more successful in deciphering other's emotional states are more successful, both socially and vocationally (Gray et al, 2010). Deficits in emotion recognition have been tied to poor social competence, interpersonal functioning, and communication along with a reduced quality of life and inappropriate social behavior (Ruffman et al, 2008). Therefore, this issue is of significant importance to current scientific research, as a better understanding can lead to the development of clinical interventions. Although a significant amount of research has been dedicated to the study of emotion recognition ability in disorders such as autism, schizophrenia, depression, and Parkinson's disease, recent experimental evidence suggests that emotion recognition ability across visual and auditory modalities seems to change in an age-dependent way. Changes in emotion recognition also appear to be restricted to negative emotion stimuli, which when grouped together can be referred to as negative "valence", possibly reflecting a general strategy of older individuals to focus on positive experiences (Ruffman et al, 2008). The question that this study seeks to answer is whether or not these age-related deficits in emotion recognition ability occur across visual and auditory modalities. Therefore, the primary purpose of this study is to assess emotion recognition ability in both the visual and auditory modalities in healthy elderly patients versus healthy young patients to test the hypothesis that deficits in emotion recognition ability are age-related and increase with age across visual and auditory modalities. The secondary purpose of this study is to assess valence-specific emotion recognition ability to test the hypothesis that increased deficits for elderly individuals as compared to young healthy subjects occur for negative emotion recognition specifically.

Methods

Subjects

We examined the ability to recognize emotion in the auditory and visual modality in two groups of patients: healthy elderly subjects and healthy young subjects. The Weschler abbreviated scale of intelligence (WASI) and the Weschler test of adult reading (WTAR) were used to exclude those elderly patients who had dementia. All healthy young subjects that were run on the visual and auditory tasks met pre-screening restrictions regarding such things as drug use or medical conditions that could affect cognition. Average demographic information for age, Heaton level of education and IQ (WASI/WTAR scores) are shown in Table 1. All of the tasks were run in the same session lasting approximately 90 minutes at the Vanderbilt Functional Neurosurgery lab, the Vanderbilt Neurosurgery Clinic, or the Park Clinical Neuroscience Lab. This study was approved by the Vanderbilt Institutional Review Board and everyone participating in the study provided informed consent.

Table 1. Average Demographic Information of Elderly and Young Populations (WASI not conducted for YC)

	WTAR	WASI	AGE	HEATON
EC	113.22	118.59	63.13	15.28
YC	109.86	----------------	20.09	13.55

Tests on accuracy data were performed in SPSS (IBM, NY). Accuracy data for each subject was converted from binomial distribution to normal distribution by an arcsine transform, allowing us to perform parametric tests such as t-test and ANOVA.

Visual Tasks: TASIT and Baron-Cohen

In terms of visual tasks, we administered the Awareness of Social Inference test (TASIT) and the Baron-Cohen Mind in the Eyes test. The TASIT consists of videotaped vignettes of everyday social interactions and has three parts, of which we used the Emotion Evaluation Test (EET). The EET assesses recognition of spontaneous emotional expression (happy, surprised, sad, anxious, angry, disgusted, and neutral) (McDonald et al, 2003). Alternate forms of the EET (TASIT A, TASIT B) were counterbalanced within both groups of healthy elderly patients and healthy young patients. To take into account variability in difficulty of either version of the TASIT, we analyzed the difference in overall accuracy and valence-specific accuracy between both A and B versions. In terms of the Baron-Cohen Mind in the Eyes test, sets of black and white images of eyes are shown to patients with instructions to choose from a set of answer choices regarding the word that best describes what the person in the image is thinking or feeling (Baron-Cohen et al, 2001).

Auditory tasks: Montreal Affective Voices and Distorted Tunes Test

The auditory tasks used to test emotion recognition ability in this study were the Montreal Affective Voices task (MAV) and the Distorted Tunes Test (DTT). The Montreal Affective voices task consists of 90 nonverbal affect bursts corresponding to the emotions of anger, disgust, fear, pain, sadness, surprise, happiness, and pleasure (plus a neutral expression), recorded by 10 actors (5 male, 5 female) (Belin et al, 2008).

We also administered the reliable and ecologically valid Distorted Tunes Test (DTT) which requires subjects to judge whether simple popular melodies contain notes with incorrect pitch (Braun et al, 2008; Drayna et al, 2001). This allows us to approximate that our methods, materials, and settings of the study resemble the real-life situation that is under investigation.

Results

Visual Tasks: TASIT and Baron-Cohen

For the TASIT, the elderly and young populations had similar mean overall accuracies (see Figure 4). This finding was confirmed by a t-test ($t(31)=1.42$, $p=0.17$). To see if these populations contained any significant valence-specific differences (see Figure 5), we performed a planned 2X3 (group X valence) repeated measures ANOVA. There was not a significant effect of valence ($F(2,30)=.706$, $p=.50$) or group*valence ($F(2,30)=.632$, $p=0.54$), indicating that these groups performed similarly in a valence specific way. The group effect also confirmed our initial findings from the t-test, proving that the difference in accuracy was not statistically significant between the two populations.

For the EYES test, the elderly and young populations had similar mean overall accuracies (see Figure 6). This finding was confirmed by a t-test ($t(25)=-1.217$,$p=0.24$). To see if these populations contained any significant valence-specific differences (see Figure 7), we performed a planned 2X3 (group X valence) repeated measures ANOVA. There was not a significant effect of valence ($F(1,25)=.243$,$p=0.63$) or group*valence ($F(1,25)=3.715$,$p=.07$), indicating that these groups performed similarly in a valence specific way. The group effect also confirmed our initial findings from the t-test, proving that the difference in accuracy was not statistically significant between the two populations.

Auditory Tasks: Montreal Affective Voices and Distorted Tunes Test

For the DTT, the elderly and young populations had relatively similar baseline accuracy (see Figure 3). This finding was confirmed by a t-test ($t(29)=1.132$,$p=.27$), indication that the difference in accuracy was not significant.

For the MAV, the elderly and young populations show a difference in overall performance on the task (see Figure 1). This initial finding was confirmed by a t-test ($t(35)=0, p<0.01$). To see if these differences were valence specific (see Figure 2), we performed a planned 2X3 (group X valence) repeated measures ANOVA. There was a significant effect of valence ($F(2,34)=65.98, p<0.01$) and group*valence ($F(2,34)=8.477, p<0.01$) indicating that these groups performed differently in a valence specific way. The group effect also confirmed our initial findings from the t-test.

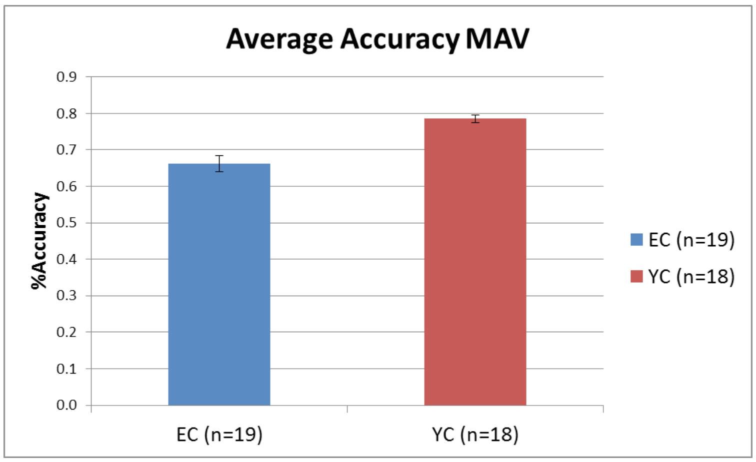

Figure 1. MAV Baseline Average Accuracies by Population (error bars are standard error of mean)

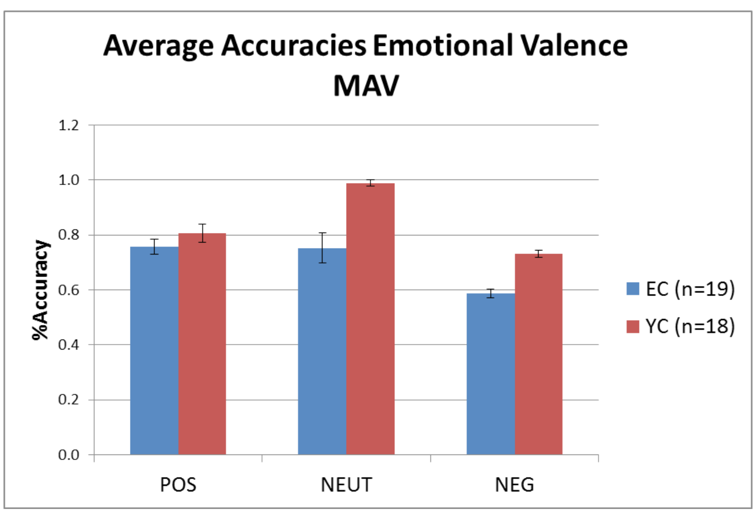

Figure 2. MAV Valence-Specific Accuracies by Population (error bars are standard error of mean)

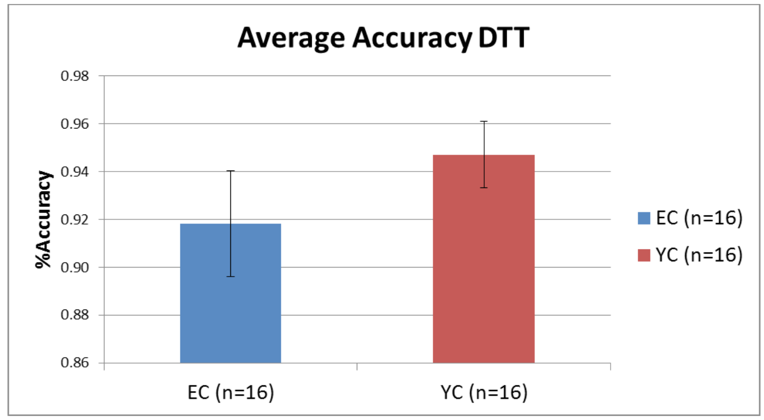

Figure 3. DTT Baseline Average Accuracies by Population (error bars are standard error of mean)

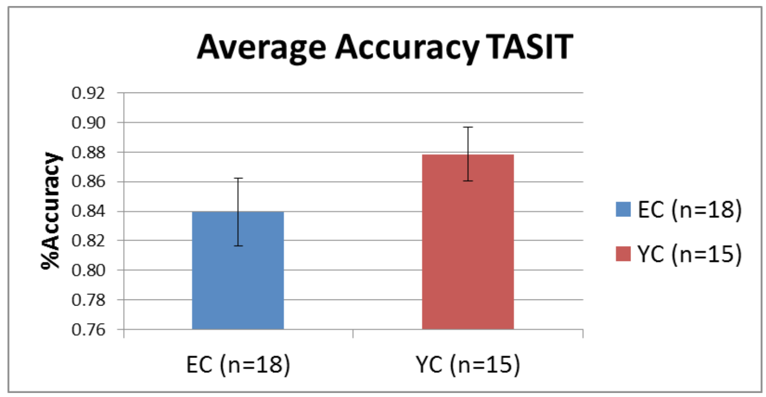

Figure 4. TASIT Baseline Average Accuracies by Population (error bars are standard error of mean)

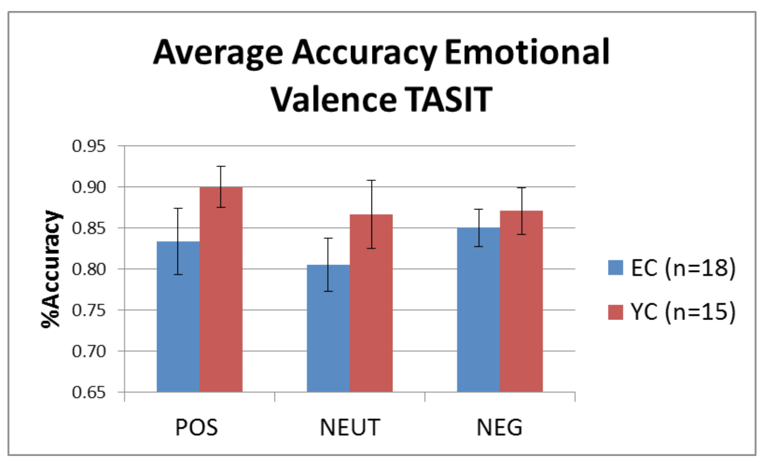

Figure 5. TASIT Valence-Specific Accuracies by Population (error bars are standard error of mean)

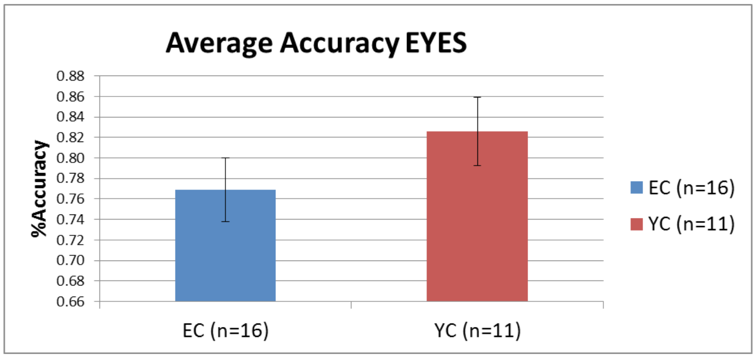

Figure 6. EYES Baseline Average Accuracies by Population (error bars are standard error of mean)

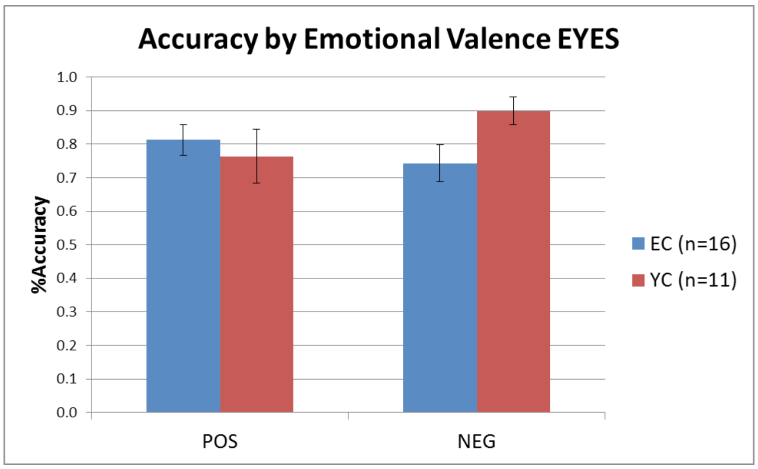

Figure 7. EYES Valence-Specific Accuracies by Population (error bars are standard error of mean)

Discussion

For the auditory tasks, the MAV was the only task that returned statistically significant differences in baseline accuracies and valence-specific performance between healthy elderly and young populations. In addition, the DTT returned insignificant differences between the two populations in baseline accuracy or valence-specific performance. This suggests that there exist specific age-related deficits in recognizing auditory emotion that are separate from the ability to process sound in general. This finding is in accordance with recent research showing that elderly populations have deficits in performance on auditory emotion tasks (Ruffman et al, 2009; Ruffman et al, 2008; Mill et al, 2009).

For the visual tasks, the TASIT and EYES task both returned insignificant differences in baseline accuracy and valence-specific performance between the two populations. This is not in accordance with recent research on age-related emotion recognition deficits, especially in recognizing emotion in faces (Sullivan & Ruffman, 2004; Orgeta & Phillips, 2008).

This disparity may be explained by differences in the demographic profile of our elderly subjects. It may also be due to the fact that our visual tasks did not test the same ability to recognize emotion as did the other studies, the majority of who tested emotion recognition ability from static images of faces. The TASIT requires the integration of contextual information from social interactions, and the EYES task focuses only on the information regarding emotion that can be gathered from the eyes, without any other information regarding emotion included. Another explanation for the disparity of our results with recent research on age-related deficits in visual emotion recognition may be due to task difficulty, as it has been suggested that task difficulty moderates age differences in emotional labeling (Orgeta, 2010).

In terms of questions for further study, the first objective would be to establish which valence-specific emotions resulted in greater deficits for elderly subjects and compare this to current research regarding age-related deficits for negative emotion recognition. A second objective would be to test the effect of task difficulty on emotion recognition ability as it relates to the MAV, DTT, TASIT, and EYES. Another avenue for future study could be the study of tasks that involve the integration of auditory and visual emotion recognition abilities.

All in all, this research is of significant importance as impairment in emotion recognition is not only of concern as an age-related deficit, but also as a possible effect of diseases such as autism and Parkinson's disease. It is important to be able to establish an age-related deficit so as to not confuse this deficit with those experienced in aforementioned diseases, and also for the development of clinical interventions for deficits in emotion recognition that could have a crippling effect on one's quality of life.

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