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Age and the Understanding of Emotions: Neuropsychological and Sociocognitive Perspectives

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Sociocognitive approaches suggest that the ability to understand emotions should be well maintained in adult aging. However, neuropsychological evidence suggests potential impairments in processing emotions in older adults. In the current study, 30 young adults (aged 20–40 years) and 30 older adults (aged 60–80 years) were tested on a range of emotional ability measures. There were no age effects on the ability to decode emotions from verbal material. Older people were less able to identify facial expressions of anger and sadness, and showed poorer ability to identify theory of mind from pictures of eyes. The results indicate specific age-related deficits in identifying some aspects of emotion from faces, but no age effects on the understanding of emotions in verbal descriptions.

THE ability to interpret emotional cues has been argued to play an important role in maintaining successful relationships and healthy psychological functioning (e.g., Carton, Kessler, & Pape, 1999). Carton and colleagues show that the ability to decode emotional cues from faces and voices relates to relationship well-being and depression scores in a nonclinical sample. Good ability to understand emotions also relates to overall life satisfaction (Ciarrochi, Chan, & Caputi, 2000). Relatively little is known about adult age differences in emotion understanding. In the current study, we investigate the effect of age on key tasks from the psychometric and neuropsychological literature that aim to assess the understanding of others' emotions.

The majority of studies that have examined age effects on emotions have taken a sociocognitive perspective. Sociocognitive theories propose that with age there is an increased ability to understand and regulate emotions (e.g., Carstensen, Isaacowitz, & Charles, 1999; McConatha, Leone, & Armstrong, 1997; Pasupathi, Carstensen, Turk-Charles, & Tsai, 1998), because of increasing optimization of positive mood states and increased skill at understanding cues to emotional meaning. Older adults have had extensive life experience of analyzing emotional cues in interpersonal communication, and therefore it seems plausible that this skill might be preserved or improve with age (Dougherty, Abe, & Izard, 1996) For example, Magai (2001) suggests that with increasing age, people develop better ability to understand, anticipate, and react to the emotional responses of other people, because of accumulated interpersonal experience across the life span.

There have been few published studies that take a neuropsychological viewpoint on age differences in emotional processing. However, there is a growing body of literature on the involvement of particular brain regions in emotion processing, and these overlap with the brain regions known to be most affected by normal aging. Two brain areas that have been implicated in emotional processing in a number of patient and neuroimaging studies are the frontal lobes and medial temporal lobes (e.g., Davidson & Irwin, 1999). For example, there is evidence that patients with lesions to the frontal lobes or regions within the medial temporal lobes show poorer ability to decode emotions from vocal and facial expressions (Hornak, Rolls, & Wade, 1996; Scott et al., 1997), and poorer ability to understand emotions described in stories (Blair & Cipolotti, 2000). Such patients also perform poorly on tasks demanding *theory of mind*—the ability to understand others' feelings or thoughts (e.g., Rowe, Bullock, Polkey, & Morris, 2001; Stone, Baron-Cohen, & Knight, 1998). The frontal and medial temporal lobes are among the brain areas known to show earliest and most rapid decline in normal adult aging (e.g., Petit-Taboué, Landeau, Desson, Desgranges, & Baron, 1998). Cognitive processes such as executive function and episodic memory, which are mediated by the frontal lobes and medial temporal lobes, are known to show age-related decline.

Sociocognitive perspectives, therefore, predict age stability or improvement in understanding emotions, whereas neuropsychological perspectives predict age decline in understanding emotions. The aim of the present study is to examine which of these patterns of age effects is seen on emotion understanding tasks involving verbal and nonverbal stimuli taken from the psychometric and neuropsychological literature. We used two tasks from a battery of emotional intelligence tests. One (Stories) assesses the ability to detect the presence of particular emotions in text, and the other (Blends) assesses the ability to determine which basic emotions combine to produce more complex emotions such as jealousy. A questionnaire measure of emotional empathy was used to assess the tendency to understand and relate to others' feelings. The ability to assess basic emotions from photographs of faces was assessed, along with the ability to detect subtle differences in mental states from photographs of eyes. Each of these tasks has been used to assess different aspects of emotional understanding: (a) decoding basic emotions from facial expressions (Faces test); (b) distinguishing complex emotions from pictures of eyes (Eyes test); (c) determining emotional intensity from passages of text (Stories test); (d) understanding of complex emotional terms (Blends test); and (e) self-assessed understanding and ability to relate to others' feelings (Empathy questionnaire).

Few studies have used a range of different emotion understanding measures, so it is not known whether these measures test overlapping or separable abilities.

Being able to identify others' emotions from facial information or written descriptions is seen as a key component in the concept of *emotional intelligence* (Mayer, 2001), along with the ability to empathize with others' emotions (Bar-On, 2001). It might, therefore, be predicted that the different emotion understanding measures would correlate together because of their common contribution to emotional intelligence. In the current study, age group differences in these emotional abilities are also investigated in relation to fluid or crystallized intelligence. Fluid intelligence may influence emotional understanding tasks that involve analysis of novel or complex stimuli. Crystallized intelligence may influence emotion understanding because both abilities depend on acquired knowledge and skills.

The pattern of age decline on fluid intelligence tests, along with stability or improvement on crystallized intelligence tests, is well established. However, little is known about the effects of aging on emotional intelligence. Mayer, Caruso, and Salovey (1999) propose that emotional intelligence reflects a different facet of intelligence than fluid and crystallized abilities. Mayer and colleagues have developed a battery of emotional intelligence tasks (the Multidimensional Emotional Intelligence Scales [MEIS]) that predict key criteria such as life satisfaction and empathy for others along with people's ability to regulate their mood (Ciarocchi et al., 2000). Empathy has often been described as a critical part of emotional intelligence, and emotional empathy is defined as both the recognition of others' feelings and the sharing of those feelings (Mehrabian & Epstein, 1972). In young student populations MEIS scores correlate moderately with verbal intelligence (Mayer et al., 1999), but poorly with fluid intelligence (Ciarocchi et al., 2000). This evidence suggests that emotional intelligence does not entirely overlap with standard fluid and crystallized intelligence measures—however, this has not been assessed in a group comprising a wide range of ages.

The task most widely used to investigate emotion understanding in neuropsychological research is the labelling of facial expressions of basic emotions. A number of studies have examined the effect of age on the ability to identify emotional tone from faces. Moreno, Borod, Welkowitz, and Alpert (1993) investigated age effects on 16 black and white pictures of emotional expressions. There was no overall age effect on emotion identification, but a significant interaction was found such that older participants were worse at identifying sadness but better at identifying happiness compared with younger participants. Using the same stimuli, McDowell, Harrison, and Demaree (1994) found that older adults were less able to discriminate between the different negative emotions. MacPherson, Phillips, and Della Sala (in press) examined age differences in labelling emotions from color photographs of faces. There was an interaction between age and emotion type such that older adults were impaired in identifying only one type of emotion out of seven—sadness.

Theory of mind (TOM) is conceptualized as the ability to understand others' emotions, motivations, and thoughts, and to understand their behavior accordingly. Some studies have suggested that performance on TOM tasks is related to the ability to identify facial expressions of emotion (e.g., Buitelaar, van der Wees, Swaab-Barneveld, & van der Gaag, 1999). The development of TOM in children has been extensively studied, and the TOM tasks that are sensitive to developmental changes tend to assess knowing what someone else knows. Research on TOM in adults has concentrated on the understanding of emotions and social conventions. The study of TOM in adults has centered around attempts to explain the social and emotional difficulties of individuals with autism. The few studies of aging effects on TOM tasks have produced apparently contradictory results. Happé, Winner, and Brownell (1998) found that an older group performed better than younger adults on a verbal TOM test and suggest that this reflects greater social sensitivity with age. In contrast Maylor, Moulson, Muncer, and Taylor (in press) found an age decrease in the ability to decode TOM using the same task. Maylor and colleagues argue that this discrepancy occurs because of an unusually high-functioning older group in the Happé and colleagues study. MacPherson and colleagues (in press) found no effect of age on a different verbal TOM task that examined understanding of social faux pas.

These verbal tasks of TOM resemble problem-solving tasks in that complex passages of text are presented and have to be analyzed. Also the tasks have a memory component that may partially explain age differences (Maylor et al., in press). These tasks, therefore, may not tap naturalistic TOM that people use from moment to moment to infer mental states. Baron-Cohen, Jolliffe, Mortimore, and Robertson (1997) describe the nonverbal Eyes test of TOM that is specifically designed for use with adults and investigates ability to determine another's thoughts or feelings from a picture of their eyes. They describe the task as one of mindreading. Adults with autism showed poorer ability than controls to understand mental states from the pictures of eyes (Baron-Cohen et al., 1997). This task differs from identifying basic facial expressions of emotion in that the distinctions made involve more complex emotional terms and often concern social interaction (e.g., distinctions include attraction or repulsion, friendly or hostile, noticing you or ignoring you). There have been no previous studies published investigating normal age effects on the Eyes test.

In the current study, we address the following research questions:

1. *Do older adults show better or worse understanding of emotions than younger adults do*? It can be hypothesized that age will affect the ability to understand emotions; however, the direction of the predicted age effect is different depending on which theoretical stance is adopted. Sociocognitive approaches suggest that there should be age-related improvement in the ability to understand others' emotions. In contrast, neuropsychological changes with age predict age-related decline in performance on tests of emotion understanding.
2. *Can any age effects on emotion understanding be explained in terms of fluid or crystallized ability or years of education*? Given the current debate about whether

emotional understanding reflects a separable ability from fluid and crystallized intelligence, it is important to identify whether any age differences in emotional processing are separable from age changes in other ability measures. Education was also added as a covariate because generational changes in the average length of educational experience might potentially impact on understanding of emotions.

3. *What is the relationship between different tasks that assess the understanding of emotions?* Do the tasks tend to correlate together, suggesting a general factor of emotional understanding?

Methods

Participants

We recruited 30 young (aged 20–40 years, $M = 29.9$ years, $SD = 7.1$), and thirty old (aged 60–80 years, $M = 69.2$ years, $SD = 6.1$) participants into the study from the local participant volunteer panel. The younger group comprised 11 men and 19 women, the older group 15 men and 15 women. The age groups differed in terms of years of education, $t(58) = 2.98$, $p < .01$ (young $M = 14.45$ years, $SD = 2.79$, old $M = 12.20$ years, $SD = 3.11$). Individuals were only included in the study if they reported no history of neurological or psychiatric illness. All participants except one scored above the recommended cutoff on the Incomplete Letters subtest of the Visual and Object Space Perception Battery (Warrington & James, 1991), indicating normal visual perception. The one individual with a lower visual perception score (15/20) performed well above average on the faces and eyes tests.

Materials and Procedure

The following tasks were given in one of two counterbalanced orders:

MEIS.—We gave two subtests (Stories and Blends) from the MEIS (Mayer et al., 1999) to participants. We assessed performance on each subtest (as recommended by the test authors) using *consensus scores*. These consensus scores assess the percentage of a sample population composed largely of college students who gave the same response as the participant. A high consensus score for an individual therefore indicates good agreement with the majority of those from the sample population of Mayer and colleagues.

Stories. This is described as the most important and predictive task from the MEIS battery (Mayer et al., 1999). This scale contains six short stories, each describing the emotions and thoughts of an individual. For each story, we asked participants to indicate on a 5-point scale the extent to which the person telling the story was experiencing seven emotions (e.g., envious, lively, ashamed, etc.). The reliability of this scale is reported to be $\alpha = .85$ (Mayer et al., 1999), and the scores obtained in the current study ranged from 8.21 to 19.35.

Blends. In this multiple-choice task, we asked participants to choose which combination of emotions go together to make more complex emotions such as awe or contempt. The reliability of this scale is relatively poor ($\alpha = .49$, Mayer et al., 1999). Scores in the current study ranged from 2.19 to 4.97.

Empathy.—Participants completed the Mehrabian and Epstein (1972) emotional empathy questionnaire. This consists of 33 statements that participants rate on a 9-point scale in terms of how strongly they agree or disagree that each statement describes them. Items include "It makes me sad to see a lonely stranger in a group" and "Another's laughter is not catching for me." The reliability of this questionnaire is reported to be $\alpha = .81$ (Ciarrochi et al., 2000), and the scores in the current study ranged from 104 to 254, with higher scores indicating greater empathy.

Faces.—We presented participants with a sequence of 24 photographs from the black and white Ekman and Friesen (1976) set of faces, 4 each of: (a) anger, (b) happiness, (c) fear, (d) disgust, (e) sadness, and (f) surprise. For each face, participants had to identify which of the six emotion labels best described the face. Obtained scores ranged from 17 to 24.

Eyes.—We presented participants with the 25 stimuli from Baron-Cohen and colleagues' (1997) Eyes test designed to assess TOM. For each pair of eyes presented, they were asked to choose which of two words best assessed what the person in the picture was thinking or feeling (e.g., for the first stimulus the choice to be made was between "concerned" and "unconcerned"). Most of the distinctions to be made had an emotional dimension. Scores ranged from 15 to 24 in the current study.

Wechsler Adult Intelligence Scales, 3rd Edition (WAIS III) subtests.—Participants completed the Matrix reasoning and Vocabulary subtests from the WAIS III (Wechsler, 1997) to assess fluid and crystallized ability, respectively.

Results

Performance of the young and old age groups on the tasks are reported in Table 1. We performed a multivariate analysis of variance to examine the magnitude and direction of age effects on the five emotion understanding tasks: the MEIS Stories and Blends tasks, Empathy, Faces, and Eyes. There was no effect of age group on the two emotional intelligence tasks: Stories, $F(1,58) = .07$, $MSE = 5.16$, $\eta_p^2 = .00$, or Blends, $F(1,58) = .18$, $MSE = 0.27$, $\eta_p^2 = .00$. A significant age effect was found on Empathy, $F(1,58) = 4.88$, $MSE = 719.14$, $\eta_p^2 = .08$, $p < .05$, with older adults producing lower empathy scores. There was no significant

Table 1. Performance of Young and Old Adults on the Emotion Understanding Tasks and Fluid and Crystallized Intelligence Tests

Group	Stories	Blends	Empathy	Faces	Eyes	Matrix	Vocabulary
Young							
M	15.61	4.43	203.00	21.80	19.77	20.00	52.60
SD	2.10	0.54	30.60	1.54	2.25	3.43	8.64
Old							
M	15.76	4.37	187.70	21.33	18.60	15.67	55.37
SD	2.42	0.50	22.41	1.77	1.75	5.46	9.34

Table 2. Correlations Between Different Emotion Understanding Measures and Fluid and Crystallized Abilities

	Stories	Blends	Empathy	Faces	Eyes	Matrix	Vocabulary
Blends	.415*						
Empathy	.188	−.041					
Faces	.192	.281*	.111				
Eyes	−.017	−.059	.168	.084			
Matrix	.193	.204	.192	.360*	.100		
Vocabulary	.426*	.454*	.206	.342*	.042	.213	
Education	.054	.106	.432*	.164	.031	.500*	.328*

$^* p < .05$.

age effect on identifying emotions in the Faces task, $F(1,58) = 1.96$, $MSE = 2.75$, $\eta_p^2 = .03$, but the older group performed significantly worse than the young group did on the Eyes TOM task, $F(1,58) = 5.01$, $MSE = 4.08$, $\eta_p^2 = .08$, $p < .05$. To identify whether there were age differences in the ability to identify particular emotions in the Faces task, a series of chi-squared analyses investigated how many of the young and old participants made any errors at all for each emotion type. Happiness was not analyzed because every participant correctly identified all four happy faces. There were no age effects on surprise, $\chi^2(N = 60) = 1.36$, disgust, $\chi^2(N = 60) = 1.27$, or fear, $\chi^2(N = 60) = 0.28$. However, older people were significantly more likely to make errors on anger $\chi^2(N = 60) = 5.41$, $p < .05$, and sadness, $\chi^2(N = 60) = 4.81$, $p < .05$.

We performed multivariate analysis of covariance (MANCOVA) to examine whether the age effects on the emotion understanding tasks might be explained in terms of general age-related change in years of education and fluid and crystallized ability. In this MANCOVA, the age effect on Empathy score was nonsignificant, $F(1,55) = 2.34$, $MSE = 636.67$, $\eta_p^2 = .04$. The effect of age on Eyes test performance remained significant, $F(1,55) = 5.61$, $MSE = 4.19$, $\eta_p^2 = .09$, $p < .05$. Age effects on the other emotion measures remained nonsignificant.

Older adults had lower scores on Matrix reasoning compared with young adults, $t(58) = 3.68$, $p < .001$, but there was no age effect on Vocabulary, $t(58) = -1.19$. Table 2 shows the correlations of the emotion measures with years of education and Matrices and Vocabulary subtests from the WAIS. The Stories and Blends subtests of the MEIS correlated significantly with Vocabulary, but not Matrix scores or education. Face emotion identification related to both Vocabulary and Matrix performance. Eyes performance did not relate significantly to the WAIS subtests or education. Empathy scores related to education, but not WAIS subtests. There were few significant relationships between the different emotion understanding measures, with MEIS Blends scores correlating with Stories and Faces performance.

Discussion

There are no age differences on the two emotional intelligence scales used here (Stories/Blends). This suggests that there is broad agreement across the age range about the interpretation of verbal descriptions of emotions. The fact that both the Stories and emotional Blends subtests from the MEIS correlate more highly with vocabulary than fluid intelligence suggests that these tests tap knowledge rather than fluid ability. This result also fits with findings from college populations that MEIS scores correlate significantly with verbal intelligence (Mayer et al., 1999).

There is no overall age effect on identifying emotions from faces. However, when individual emotions are examined, significant age impairments in the ability to identify anger and sadness are found. This is not due to these emotions being the most difficult to identify, because for both age groups fear is the emotion most likely to be misidentified. The current results concur with other studies suggesting that negative emotions such as sadness and anger are susceptible to age differences in identification (McDowell et al., 1994; Moreno et al., 1993). This might be related to decreased experience of these emotions in older adults (Gross et al., 1997). A neuropsychological explanation can also be proposed. Perceiving anger and sadness seems to involve the frontal cortex and right temporal pole, whereas perceiving other emotions may depend more upon regions such as the amygdala (fear), or insular cortex (disgust; Davidson & Irwin, 1999). It might be proposed therefore that age differences in ability to identify sadness and anger reflect age changes in the frontal and temporal lobes. In common with the present study, most investigations of age and emotion recognition have relied on the Ekman battery of faces, so it is possible that something specific to the posed nature of these expressions may influence the age differences found on individual emotions. Also, it is not clear whether any specific age-related deficit in identifying sadness or anger might extend to different modalities (e.g., tone of voice, identifying emotions from verbal descriptions). In the current study, it was not possible to analyze individual emotions from the MEIS Stories tests.

Age differences favoring younger adults are found on both the Eyes TOM task and the Empathy scale. This might reflect a common component of these tasks—for example, Flury and Ickes (2001) argue that “empathic accuracy involves ‘reading’ people’s thoughts on a moment-to-moment basis” (p. 113), suggesting that empathy depends on TOM. However, scores on the Eyes and Empathy scales are poorly correlated, and although Empathy correlates significantly with education, Eyes scores do not. Age effects on Empathy are removed when intelligence and education are covaried. This suggests that the age effects found on Empathy scores reflect more general age effects on education and ability, as opposed to a specific impairment of emotional processing. Trends for older people to score lower on empathy questionnaires have also been reported on Eysenck’s Empathy scale (Eysenck & Eysenck, 1991).

Older adults’ poor performance on the Eyes task and poorer identification of faces showing sadness and anger, taken alongside evidence of intact performance at identifying emotions in the Stories task, suggests age-related changes in identifying at least some aspects of emotions from faces rather than a general age change in emotion understanding. However, overall there is no relationship between performance on the Eyes and Faces tasks, suggesting that these tasks assess different aspects of facial processing. These age changes in identifying emotional cues from faces are unlikely to be due purely to poorer visual perception, because this is screened in the current study. Age effects on Eyes performance remained significant when intelligence and education are covaried, suggesting that any age deficits in facial emotion processing do not reflect general age-related changes in ability or demographic factors.

There is no evidence of an age improvement in emotion understanding due to increased experience in interpreting emotional cues. On the majority of measures of emotion understanding, including tasks aimed to assess emotional intelligence, there is no evidence of age-related change. Some evidence is found of age-related deficits in the ability to identify sad and angry facial expressions and to interpret mental states from pictures of eyes. This may reflect a specific deficit of aspects of facial emotion processing in older adults.

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