



Social perception and aging: The relationship between aging and the perception of subtle changes in facial happiness and identity

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ABSTRACT

Previous findings suggest that older adults show impairments in the social perception of faces, including the perception of emotion and facial identity. The majority of this work has tended to examine performance on tasks involving young adult faces and prototypical emotions. While useful, this can influence performance differences between groups due to perceptual biases and limitations on task performance. Here we sought to examine how typical aging is associated with the perception of subtle changes in facial happiness and facial identity in older adult faces. We developed novel tasks that permitted the ability to assess facial happiness, facial identity, and non-social perception (object perception) across similar task parameters. We observe that aging is linked with declines in the ability to make fine-grained judgements in the perception of facial happiness and facial identity (from older adult faces), but not for non-social (object) perception. This pattern of results is discussed in relation to mechanisms that may contribute to declines in facial perceptual processing in older adulthood.

1. Introduction

Our ability to correctly perceive and interpret social cues (social perception) is a critical component of human life. One important source of social signals is the face. For instance, from a face we are able to judge if someone we meet is a friend or a stranger (i.e. their identity), whether that person is pleased or upset to see us (e.g. if they are happy, angry, or sad), and make trait judgments about that person's character (e.g. judging if they look trustworthy or aggressive). While these processes are relatively rapid, they can have profound effects on our behaviour. For example, emotional facial expression perception plays an important role in interpersonal communication (Ruffman, Henry, Livingstone, & Phillips, 2008; Ryan, Murray, & Ruffman, 2009), and difficulties with social perception are associated with a range of psychosocial consequences (e.g., Kanai et al., 2012; Spell & Frank, 2000). It is therefore unsurprising that considerable research interest has focused on establishing how the capacity for social perception varies across individuals.

In recent decades, there has been a focus on age differences in facial emotion recognition. The general pattern that has emerged is that older adults appear to have declined recognition of negative facial expressions of emotions such as anger, sadness, fear and surprise (e.g.

McDowell, Harrison, & Demaree, 1994; Phillips, MacLean, & Allen, 2002; Calder et al., 2003; MacPherson, Phillips, & Sala, 2006; Sullivan & Ruffman, 2004; Isaacowitz et al., 2007; see Ruffman et al., 2008 for review). There are, however, some factors that can influence emotion perception changes linked with aging. These include the use of dynamic versus static stimuli (Murphy, Lehrfeld, & Isaacowitz, 2010; Riediger, Studtmann, Westphal, Rauers, & Weber, 2014), the type of target expression (see Ruffman et al., 2008 for review), and the age of the face expressing the emotion (e.g. see Folster, Hess, & Werheid, 2014 for review).

With regard to target expression, there is some evidence to suggest that while older adults show reductions in the perception of negative emotions (e.g. anger, sadness, fear) the perception of positive emotion can be spared. One explanation suggested for this difference is that older adults may show a preference to engage/encode signals that promote positivity, emotional balance, and well-being (socio-emotional selectivity theory - Carstensen & Charles, 1998). An alternative explanation for reduced negative emotion, but spared happiness perception during aging is that in several studies happiness recognition performance was at ceiling for at least one age group tested (e.g. Brosigole & Weisman, 1995; Isaacowitz et al., 2007; McDowell et al., 1994; Moreno, Borod, Welkowitz, & Alpert, 1993; Orgeta & Phillips,

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2007). Indeed, a general limitation involved in most previous research is that only high-intensity prototypes of facial expression images have been used. This is problematic for two reasons. Firstly, it is known that the ability to correctly perceive facial emotional expressions can vary across different prototypical emotions (i.e. they are not matched for difficulty; e.g. see Calder et al., 2003), thus comparisons in performance differences across emotion types can be difficult. Secondly, although the study of high intensity emotion has proved useful, more subtle facial expression that have lower intensities are common in daily social interactions (Orgeta & Phillips, 2007).

There have been fewer investigations into age-related perceptual differences when using low intensity emotion stimuli (Hess, Blairy, & Kleck, 1997; Orgeta & Phillips, 2007). Those that have done so indicate that older adults show impairment in the perception of low intensity emotions of sadness, anger and fear, however no differences in happiness, disgust, or surprise perception were observed (Orgeta & Phillips, 2007). A number of questions remain: e.g. a) are these differences a consequence of domain-specific deficits in subtle emotion perception or more domain-general shifts in the ability to make fine-grained visual discrimination, b) could the lack of age-related effects in certain emotions relate to task sensitivity (e.g. better performance on happiness perception relative to other emotion types), and c) to what extent do these results hold when controlling for perceptual biases that may aid younger adults over older adults during task completion?

In relation to perceptual biases that might affect relationships between aging and social perception, one issue is the other-age effect: where participants tend to show superior performance in perception of own versus other age faces (Anastasi & Rhodes, 2005; Ebner, He, & Johnson, 2011; Ebner & Johnson, 2009; Wright & Stroud, 2002). While there have been some studies comparing older and younger adults in the ability to perceive emotion from faces displayed by younger and older adult actors using prototypical emotions (Ebner et al., 2011), prior work examining low intensity emotion perception in older adults has tended to use young adult faces as target stimuli. In this regard one could argue that declines in performance displayed by older adults in previous research were related to the use of young adult actors in the task, which favours young adult participants.

In addition to facial expression perception, there is prior work suggesting that facial identity perception abilities may decline with age (e.g. Bowles et al., 2009; Megreya & Bindemann, 2015). Despite an awareness of age-related changes in facial identity and facial emotion perception, most studies on the relationship between aging and social perception have only investigated one aspect of face processing at a time (i.e. emotion or identity in isolation) or used tasks that have inconsistent paradigms involving different task complexities (e.g. working memory demands). This raises questions regarding whether previously reported differences in the perception of facial emotion and facial identity rely on common perceptual mechanisms or are related to other factors (e.g. tasks that might tap additional processes to the use of perceptual cues). In this regard, prior work struggles to give a clear picture about how normal aging is related to different aspects of face perception, meaning that the extent to which age influences face identity and face expression perception abilities in a similar or different manner remains unclear.

In view of the above, the present study sought to assess social perception of subtle changes in facial emotion and facial identity shown by older adult actors using similar task parameters and levels of difficulty. To achieve these aims we developed a series of novel tests that built upon a well utilised paradigm for studying fine-grained visual discrimination of facial identity and facial emotion in younger adult participants - the Cambridge Face Perception Test (CFPT; see Section 2.2 for details; Duchaine, Germine, & Nakayama, 2007a; Duchaine, Yovel, & Nakayama, 2007b). The CFPT format requires participants to discriminate between visual stimuli on the basis of visual properties alone (Bowles et al., 2009; Duchaine et al., 2007a, 2007b). This offers

benefits to assess perceptual differences over other task formats (e.g. labelling tasks, same-different judgment tasks) that might theoretically tap additional processes alongside perceptually driven performance factors (Adolphs, 2002; Palermo, O'Connor, Davis, Irons, & McKone, 2013). For example, labelling based measures of emotion processing require additional demands of assigning a verbal label to an emotion, thus placing additional constraints on performance related to variation in emotional vocabulary (Barrett, Lindquist, & Gendron, 2007). Further, labelling and same-different judgment tasks often require increased working memory demands, thus placing additional constraints on performance related to cognitive load (Phillips, Channon, Tunstall, Hedenstrom, & Lyons, 2008). An additional benefit of the CFPT is similarity in task parameters and accuracy across the multiple versions of the measure (e.g. identity, emotion, object), which permits the ability to compare performance differences across different visual categories when task demands remain similar. If emotion perception is affected by normal aging, but facial identity and object perception remains intact, it points to the possibility that age-related declines in social perception are emotion-specific; whereas if normal aging also affects facial identity perception, it may suggest that there is a general face processing decline; finally, if it affects all tasks (identity, emotion and object) it suggests a domain-general (i.e. non-social specific) decline may account for changes in subtle emotion perception associated with typical aging.

2. Methods

2.1. Participants

Twenty-six younger adults (seven male and nineteen female; age range 18–36 years, mean age = 24 years, SD = 6 years) and twenty-seven older adults (seven male and twenty female; age range 60–77 years, mean age = 69 years, SD = 6 years) took part. All participants were native-English Caucasians, with no known history of neurological problems or language-related problems. Participants also had normal or corrected-to-normal vision. These sampling criteria were in place to ensure that participants were typical adults without any difficulties in understanding task instructions or general visual impairment difficulties. The recruitment of Caucasians was to avoid any potential confounding effect of the other-race effect on task performance in the face tasks (Tanaka, Kiefer, & Bukach, 2004). Younger participants were recruited through the university's undergraduate participant pool, and older participants were recruited from the Goldsmiths Psychology Department participant pool.

Level of education, premorbid intelligence (NART) (Nelson & Wilson, 1991), and handedness were recorded at the beginning of experiments; the two groups did not significantly differ in these factors (details given in the Results section). The Mini-Mental State Examination (MMSE) was also used as a screening evaluation to test older participants for possible dementia (Folstein, Folstein, & McHugh, 1975). The MMSE is a commonly used measure to screen for cognitive status. A cut-off limit of < 24 was used, which has a good sensitivity for dementia in the older population (Chayer, 2002). No participants were excluded from the study on the basis of this criterion. All participants gave informed consent prior to beginning the experiment and were fully informed about the experimental procedure. The local ethics committee approved the study.

2.2. Materials and procedure

We developed a series of novel tests that built upon the Cambridge Face Perception Test (CFPT). The CFPT was originally developed to study subtle differences in the perception of facial identity perception (hereafter referred to as CFPT-Identity) under conditions in which working memory demands are minimal (Duchaine et al., 2007a; Duchaine et al., 2007b), and has since been adapted to examine subtle differences in the perception of happiness (CFPT-Happy), anger (CFPT-

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