
**Does Age-Related Stereotype Threat Affect Older Adults'
Recognition of Emotion?**

by
Lianne Atkinson

A thesis submitted for the degree of Doctor of Philosophy at the University of Otago,
Dunedin, New Zealand

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Abstract

Emotion recognition is a cognitive ability that has been demonstrated to decline with age. Older adults (aged over 60) are consistently poorer than young adults (aged 18-30) at recognising anger, fear, sadness, and happiness. However, it is possible that such age differences have been exaggerated by a phenomenon known as age-related stereotype threat, whereby raising negative stereotypes about aging leads older adults to perform worse on relevant tasks. For instance, reminding older adults of stereotypes about age-related cognitive decline impairs their memory recall performance. There is reason to think that older adults' recognition of emotions might be another cognitive ability that is compromised by stereotype threat. This idea was tested over three studies.

In Study 1, young and older adults were exposed to a stereotype threat manipulation that implied either that 1) older adults or 2) young adults are expected to have inferior emotion recognition ability. A control condition (3) involved no allusion to age differences in emotion recognition. Participants completed a basic facial emotion recognition task and a task that involved identifying mental states expressed by eyes, in addition to measures of self-reported threat concerns and state anxiety. It was hypothesised that stereotype threat would lead older adults (but not young adults) to experience increased stereotype threat concerns and anxiety, which in turn, would impair older adults' emotion recognition performance. Contrary to expectations, the stereotype threat manipulation did not lead older adults to experience increased threat concerns or state anxiety. Interestingly, young adults *did* report feeling more stereotype-threatened and anxious by the implication that their age group is typically worse at recognising emotions. Neither age group experienced impairments in their recognition of facial expressions or mental states.

These findings raised questions about whether or not lay people actually believe that emotion recognition declines with age. Study 2 aimed to explore the current stereotypes about young and older adults' emotion recognition abilities, in addition to their cognitive and social competencies. The results showed that, contrary to empirical evidence, lay people believe that older adults are equal to, or even *better*, than young adults at recognising emotions. Further, whereas participants believe older adults' social competency to be comparable to that of young adults, they believe older adults' cognitive ability to be inferior.

Consequently, Study 3 involved framing an emotion recognition task as assessing either cognitive ability (believed to decline with age), social ability (believed to remain stable with age), or general abilities. It was hypothesised that older adults (but not young adults) would experience the greatest threat concerns when the task was framed as assessing cognitive ability, which, in turn, would impair their emotion recognition accuracy. Indeed, there was no effect of condition on young adults' threat concerns or emotion recognition. As expected, older adults reported significantly greater threat concerns when the emotion recognition task was framed as assessing cognitive ability, compared to the other conditions. However, older adults' emotion recognition accuracy remained unchanged, suggesting that the recognition of emotions may be one cognitive ability that is unaffected by stereotype threat effects.

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CHAPTER ONE

The ability to recognise and understand the emotions expressed by others is an important cognitive skill. However, research has reliably demonstrated that emotion recognition declines with age (Gonçalves et al., 2018; Ruffman, Henry, Livingstone, & Phillips, 2008). Older adults are worse than young adults at recognising fear, anger, sadness, and happiness expressed by faces, bodily poses, and tone of voice (Ruffman et al., 2008). It is possible, though, that the age-related decline in emotion recognition ability demonstrated in the literature has been exaggerated by *stereotype threat*, a phenomenon first demonstrated by Steele and Aronson (1995). Stereotype threat refers to the feeling that one is at risk of confirming negative stereotypes about a group to which one belongs, which may lead one to performing poorly on stereotype-relevant tasks (Steele & Aronson, 1995).

Indeed, reminding minorities (e.g., African-Americans) of negative stereotypes about their group (e.g., that African-Americans are academically inferior than whites) has consistently been shown to impair stigmatised individuals' task performance (e.g., on college tests; Nguyen & Ryan, 2008; Spencer, Logel, & Davies, 2016). Importantly for the current research question, a large body of literature indicates that reminding older adults about negative aging stereotypes worsens their performance on numerous different cognitive tasks (Lamont, Swift, & Abrams, 2015), including episodic and working memory tasks (Armstrong, Gallant, Li, Patel, & Wong, 2017), pre-dementia screening

tests (Mazerolle et al., 2017), and map learning (Meneghetti, Muffato, Suitner, de Beni, & Borella, 2015).

However, despite age-related stereotype threat being shown to reliably impair a number of cognitive abilities in older adults, there has been no investigation into the possible effects of age-related stereotype threat on older adults' ability to recognise emotions. It is possible that previous findings of age-related differences in emotion recognition have been exaggerated by stereotype threat. The current introductory chapter reviews the respective literature on the decline in emotion recognition with age, stereotype threat, and more specifically, age-related stereotype threat. In light of the reviewed literature, the overarching aims of the current research are subsequently described.

Age-Related Differences in the Recognition of Emotions

Expressing, perceiving, and recognising emotions are important capabilities that are integral in several areas of life, such as forming friendships, expressing and recognising one's needs and desires, and establishing romantic connections (Zhang & Parmley, 2015). Without emotion, human social interaction and communication would be considerably limited. Indeed, individuals whose emotion recognition is compromised can experience diminished social functioning, dysfunctional social behaviour, and a lack of interest in social interactions (Ruffman et al., 2008; Shimokawa et al., 2001). An extreme example of this is evident in autism, a psychiatric disorder involving various deficits in social interaction and communication such as developmental delays in learning everyday social skills, failure to react appropriately to social cues, and an inability to make friends (Guastella et al., 2010). These deficits are believed to be partially caused by a reduced ability to recognise other people's emotions – a theory that has been supported through numerous neurological and behavioural studies (Guastella et al., 2010).

While emotions are expressed in many ways, such as through body language, spoken language, and tone of voice, the expression and recognition of emotions primarily depends on the facial region (Russell, 1994). Ekman (1992) introduced the idea that there are at least five basic facial emotions that are universally recognised and distinguishable from one another (Russell, 1994). These basic emotions are anger, happiness, disgust, sadness, and fear, with surprise often being included too (Ekman, 1992; Russell, 1994). Each emotion is associated with distinct changes in muscle groups, such as the turning up of the corners of an individual's mouth and the wrinkling of the skin surrounding their eyes when they are feeling happy (Ekman, Friesen, & Hager, 2002). As Ekman (1992) suggested, these fundamental emotions are almost certainly designed to aid social interactions, but interestingly also occur when one is alone and out of sight of anyone. He theorised that humans rely on basic emotions because they have been adaptive in the past (both our past as a species, and our own individual past) for inter-personal interactions, and thus have now become fundamental, instinctive reactions to various life events.

However, some researchers have questioned the categorical, bottom-up nature of this basic emotion theory, instead suggesting that emotion perception might be more of a socially constructed concept determined by top-down processes, such as language and culture (e.g., Barrett, 2006; Lindquist & Gendron, 2013). Despite this controversy, there is a wealth of research supporting the idea that humans categorise facial expressions into specific emotion categories in order to facilitate an accurate and rapid response (for a review, see Brosch, Pourtois, & Sander, 2010). The categorisation of emotions likely stems from humans' innate tendency to group and classify stimuli so that sense can be made of a complex world (Brosch et al., 2010).

The recognition of emotions is a multifaceted cognitive ability that involves numerous psychological mechanisms and relies on particular regions of the brain

(Adolphs, 2002; Adolphs, Baron-Cohen, & Tranel, 2002; Pessoa, 2008; Vuilleumier & Pourtois, 2007). When recognising the emotion in another person's face, one must first direct one's attention to the face and its salient features (Phelps, Ling, & Carrasco, 2006). The ability to efficiently attend to emotional stimuli is important; for example, a rapid response to an angry face in an individual's environment may help to avoid a possible threat (Phelps et al., 2006). It has been proposed that the amygdala is largely responsible for the rapid response to emotional stimuli (Ledoux, 2002; Phelps et al., 2006) and that this response occurs before the individual has any awareness of the stimuli (Whalen et al., 1998). The amygdala may then provide feedback to the areas of the brain that subserve attention (Phelps et al., 2006). Once attending to a face, an individual must be able to perceive it and the expression that the face is portraying (Adolphs, 2002). Regions of the brain believed to be responsible for the visual perception and processing of emotional faces include the occipital cortex, fusiform cortex, amygdala, insula, and somatosensory cortex (Adolphs, 2002; Van de Riet, Grèzes, & de Gelder, 2009; Vuilleumier & Pourtois, 2007).

Over and above the perception of emotions, identifying and classifying the particular emotion being expressed must occur in order to establish how the other person is feeling and to subsequently react appropriately (Adolphs, 2002). This recognition process relies on a person's memory for previously perceived emotions, and knowledge of the stimuli and situations with which that particular emotion has been associated in the past (Adolphs, 2002). By drawing from previous experiences and one's concept of each emotion, one can then determine which of the basic emotions is being expressed by utilising one's innate ability to categorise information (Adolphs, 2002; Brosch et al., 2010). Through the integration of all of these cognitive processes, an individual may be able to successfully determine the emotion being expressed by another person.

The ability to recognise expressed emotions changes across one's lifespan. Older adults are often believed to be wise (Etezadi & Pushkar, 2013), have had many years of experience with interpersonal relationships, and are usually focussed on maintaining positive relationships with others (Mather & Carstensen, 2005). Indeed, some sociocognitive researchers argue that people do become better with age at regulating their emotions (Phillips, MacLean, & Allen, 2002) and may become better at understanding and reacting to others' emotions (Magai, 2001). However, despite this apparent increase in the ability to *regulate* emotions, research has demonstrated that the cognitive ability to accurately *recognise* emotions deteriorates with age (Gonçalves et al., 2018; Ruffman et al., 2008). Older adults have consistently been shown to be less accurate than young adults at recognising emotions across a number of modalities, including facial expressions, body language, and tone of voice (Gonçalves et al., 2018; Ruffman et al., 2008).

Isaacowitz and colleagues (2007) found that older adults were poorer than young adults at recognising anger, fear, and happiness expressed by faces. Another study indicated that older adults were less accurate than young adults when recognising anger, sadness, and happiness from both voices and bodily expressions (Ruffman, Halberstadt, & Murray, 2009). Older adults were also worse at recognising disgust, but only from bodily expressions (Ruffman et al., 2009). This study also investigated young and older adults' ability to accurately match emotions expressed vocally to emotional faces, as well as to body poses. The authors demonstrated that, when matching vocal expressions to faces, older adults were worse than young adults for anger, sadness, and happiness (Ruffman et al., 2009). When matching body poses to voices, older adults were worse than young adults for every emotion, highlighting that older adults may find this task particularly challenging (Ruffman et al., 2009).

A meta-analysis and review of age-related differences in emotion recognition revealed that older adults exhibit significantly poorer recognition of certain emotions, across all modalities (Ruffman et al., 2008). When recognising facially expressed emotions, older adults were found to be worse at recognising anger, fear, sadness – and to a lesser extent happiness and surprise – compared to young adults (Ruffman et al., 2008). However, interestingly, older adults appear to have little difficulty recognising disgust, and in some cases have actually been shown to perform slightly better than young adults at recognising disgust in faces (Calder et al., 2003; Ruffman et al., 2008), although this effect failed to reach statistical significance in Ruffman et al.'s (2008) meta-analysis. One decade later, another meta-analysis was published by Gonçalves and colleagues (2018) that analysed effects sizes from studies published since 2008. This meta-analysis provided further support for Ruffman et al.'s (2008) earlier findings that the recognition of fear, anger, sadness, and happiness declines with age (Gonçalves et al., 2018).

Older adults' difficulties in recognising emotions expressed by others may contribute to further social detriments. One study investigated young (aged 18-35) and older (aged 60-85) adults' ability to discriminate appropriate and inappropriate behaviour (i.e., faux pas) exhibited by a popular television character, David Brent, from *The Office* (Halberstadt, Ruffman, Murray, Taumeoepeau, & Ryan, 2011). Participants rated the appropriateness of David's behaviour from a number of video clips, and also completed a battery of emotion recognition tasks, where they labelled facial, vocal, and bodily expressions of emotion. As expected, older adults were worse than young adults at discriminating between appropriate behaviour and faux pas. Interestingly, this effect was completely mediated by performance on the emotion recognition tasks, implicating the recognition of emotions as an important contributor towards older adults' social understanding. Further, compared to young adults, older adults also appear to have

lowered empathic accuracy, or the ability to infer what another person is truly feeling (Ruffman, Halberstadt, Murray, Jack, & Vater, 2019). Taken together, these findings suggest that older adults not only have reduced ability to recognise basic emotions, but also experience reduced social understanding with age.

Research has supported this idea that older adults' general social understanding may be less well developed than young adults (Henry, Phillips, Ruffman, & Bailey, 2013). One important aspect of social understanding is theory of mind (ToM), a term used to describe the capability of comprehending and appreciating another's complex emotions, cognitions, mental state, and resulting behaviour, and understanding that these are distinct from our own (Henry et al., 2013; Phillips et al., 2002). In an early study comparing older and younger participants' theory of mind, Happé, Winner, and Brownell (1998) found that older adults were better on a verbal theory of mind test than young adults. They suggested that this might be because social reasoning is preserved in aging whilst non-social reasoning deteriorates (Happé et al., 1998). However, other studies have found that ToM in fact deteriorates with age, and that Happé and colleagues' (1998) study may have only found such results due to their older group being very high functioning (Maylor, Moulson, Muncer, & Taylor, 2002).

One common paradigm for examining an individual's theory of mind utilises the Reading the Mind in the Eyes Test (RMET; Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001), which requires participants to select a mental state label from four options (e.g., "jealous", "panicked", "arrogant", "hateful") that accurately describes the mental state of people whose eyes only are displayed. This test was originally designed to detect differences in ToM in people with autism, but has since been used to compare young and older adults' capability of understanding another person's complex emotional state. Phillips and colleagues (2002)

conducted a study comparing older and young adults' performance on the RMET, which demonstrated that older adults did exhibit poorer ToM than young adults. Additional studies lead to the same conclusion (e.g., Bailey, Henry, & Von Hippel, 2008; Pardini & Nichelli, 2009; Slessor, Phillips, & Bull, 2007), with researchers suggesting that age-related declines in ToM may be partially caused by older adults' lowered capacity to recognise negative emotions, or more generalised deterioration in social understanding (Moran, 2013). A meta-analytic review of 23 studies investigating age-related differences in ToM supported the idea that older adults are worse than younger adults at attributing complex mental states to others (Henry et al., 2013).

Mechanisms Underlying Age-Related Decline in Emotion Recognition

Although the exact causes of the apparent age-related decline in emotion recognition remains inconclusive, several theories have been proposed. One prominent idea is derived from the socioemotional selectivity theory, which posits that older adults may direct their attention to positive and emotionally meaningful pursuits and stimuli in order to regulate their emotions and obtain the most enjoyment from the time remaining in their lives (Carstensen, Fung, & Charles, 2003). This "positivity effect" may lead older adults to reappraise negative emotions expressed by another individual in a more positive light, in order to effectively regulate their own emotions (Mather & Carstensen, 2003; Ruffman et al., 2008). In doing so, they may incorrectly interpret and categorise negative emotions (Ruffman et al., 2008). However, if age-related declines in emotion recognition were fully explained by the positivity bias, one would expect older adults to be less accurate than young adults at recognising negative emotions but to be equally good at recognising positive emotions. Instead, research has demonstrated that older adults are sometimes worse than young adults at recognising happiness (although not always; e.g., Murphy, Leherfeld, & Isaacowitz, 2010) and usually perform equally well at recognising

disgust (e.g., Gonçalves et al., 2018; Ruffman et al., 2008). Therefore, although the positivity bias may play some role in older adults' emotion recognition (for instance, older adults are faster at recognising happy faces than angry faces; Di Domenico, Palumbo, Mammarella, & Fairfield, 2015), it is unlikely to fully explain the deficits older adults experience.

Another prominent theory is that age-related declines in emotion recognition may result from the general cognitive decline that occurs with normal aging (Ruffman et al., 2008). A number of cognitive abilities decline with age, such as memory, executive functioning, perceptual speed, inductive reasoning, and spatial orientation (Ruffman et al., 2008; Schaie, 1994), although verbal abilities and crystallised knowledge appear to remain intact (Ruffman et al., 2008). Because emotion recognition may rely on a number of fluid cognitive abilities, normal age-related decline in cognition could be partially responsible for older adults' poorer performance on emotion recognition tasks. Indeed, one study found that general cognitive functioning was related to emotion categorisation ability, such that older adults' decreased accuracy when identifying negative facial expressions was positively related to their scores on a test of general cognitive ability (Liao, Wang, Lin, Chan, & Zhang, 2017).

However, two large meta-analyses have demonstrated that, compared to young adults, older adults are equally (or more) accurate at recognising disgust (Gonçalves et al., 2018; Ruffman et al., 2008), despite disgust being one of the most difficult emotions for young adults to identify (Ruffman et al., 2008). Conversely, older adults are significantly poorer than young adults at recognising sadness (Gonçalves et al., 2018), despite sadness being the easiest negative emotion to identify for young adults (Ruffman et al., 2008). If age-related declines in emotion recognition were explained by general cognitive decline, one would expect older adults to perform worse when recognising the emotions they found

most difficult to recognise when they were younger, since age differences usually become more pronounced with task difficulty (Earles, Kersten, Mas & Miccio, 2004; Ruffman et al., 2008).

Nevertheless, further evidence has pointed towards general cognitive decline as a determinant of reductions in emotion recognition ability. Suzuki and Akiyama (2013) suggested that general cognitive decline could preferentially affect the recognition of particular emotions, but not others. In line with previous research, the authors found that older adults were worse than young adults at recognising fear, sadness, happiness, surprise, and anger, but significantly better at recognising disgust. Whereas older adults' reduced recognition of happiness, surprise, fear, and sadness was statistically explained by reductions in general cognitive ability, older adults' reduced recognition of anger and increased recognition of disgust were not. Thus, general cognitive decline may account for age-related declines in the recognition of some – but not all – emotions.

It is also possible that, over and above the general cognitive decline that occurs with normal aging, localised regions of the brain (predominantly within the frontal and temporal areas) that are involved in the recognition of facial expressions and emotions are subject to atrophy with age (Calder et al., 2003; Ruffman et al., 2008). Whereas general cognitive decline might be expected to cause a more uniform deterioration in the recognition of emotions (Ruffman et al., 2008; although see Suzuki & Akiyama, 2013), additional changes in particular cortical structures might lead to differential impairments in recognition of the emotions that rely on these structures (Calder et al., 2003; Ruffman et al., 2008). As such, age-related reductions in the recognition of sadness and fear might partially result from changes in the amygdala, whereas the ability to recognise disgust might be retained due to comparative preservation of the basal ganglia (Ruffman et al., 2008).

The idea that specific brain changes may be responsible for age-related emotion recognition decline is supported by evidence demonstrating that frontal and temporal regions of the brain deteriorate quickly in the later years of life (Bartzokis et al., 2001; Fjell et al., 2009; Raz et al., 2005), whereas some other areas undergo less change or are relatively preserved (Raz et al., 2005). However, some research appears to contradict the theory that emotion recognition declines as a result of specific neural changes. For instance, the insula (along with the basal ganglia) is one brain region that is thought to be highly specialised for the recognition of disgust (Calder, Keane, Manes, Antoun, & Young, 2000). Despite the insula being subject to deterioration with age (Persson et al., 2014), the recognition of disgust is maintained (or even improved) across the lifespan (Mather, 2016; Ruffman et al., 2008). Thus, further research is necessary to determine the extent to which specific age-related brain changes might lead to emotion recognition deficits.

In addition to the predominant theories attempting to explain age-related differences in emotion recognition, there are some further factors that may amplify or partially explain these differences. Research has demonstrated that an own-age bias may have played a partial role in older adults' poorer performance on emotion recognition tasks in some studies (Holland, Ebner, Lin, & Samanez-Larkin, 2018). The own-age bias refers to the phenomenon that individuals find it easier to recognise faces from their own age group compared to other age groups (for a meta-analysis, see Rhodes & Anastasi, 2012). This is likely due to the fact that people usually spend most of their time with others their own age, leading to a higher degree of familiarity with faces of people from their own age group than people from other age groups (Bartlett & Fulton, 1991; Ebner, Riediger, & Lindenburger, 2010). Because of this own-age bias, older adults may be at a disadvantage when asked to label facial expressions portrayed by young actors. This is somewhat

problematic given that most emotion recognition paradigms only utilise young face stimuli (Holland et al., 2018).

Researchers have since attempted to overcome this potential problem by including both young and older face stimuli. Ebner and colleagues (2010) created the FACES database, which is a set of facial stimuli that includes similar numbers of young, middle-aged, and older faces expressing six emotions: neutrality, disgust, sadness, happiness, anger, and fear (Ebner et al., 2010). However, further studies using these stimuli have shown that older adults are still less accurate than young adults at recognising anger (Ebner & Johnson, 2009) and fear (Campbell, Murray, Atkinson, & Ruffman, 2017) in young *and* older faces, thus indicating that previous findings of an age-related decline in recognition of emotions in young faces may generalise to older face stimuli also.

Another factor that may have led to the overestimation of age-related differences in emotion recognition is the fact that many emotion recognition experimental paradigms are almost devoid of context. The majority of these tasks simply utilise posed facial expressions without real-world contextual factors, which is problematic given evidence demonstrating that contextual information is integrated with facial expression when recognising emotions (Noh & Isaacowitz, 2013). This issue is especially relevant to research involving age-related differences, as research has shown that context may be more important to the processing of facial emotions for older adults than for younger adults (Noh & Isaacowitz, 2013; Richter, Dietzel, & Kunzmann, 2010). Perhaps this is because older adults depend on environmental and contextual cues to make up for cognitive decline due to aging (Isaacowitz & Stanley, 2011).

In addition, these commonly used emotion recognition tasks have limited ecological validity (Schlegel, Grandjean, & Scherer, 2014), because in real-life social interactions, people do not have to recognise emotions from motionless, posed pictures of

faces. Instead, there is much more context, including dynamic facial expression, tone of voice, and body language. Although emotion recognition tasks with modalities other than posed facial expression do exist, they usually consist of just a single modality, such as audio recordings of vocal emotional expressions or pictures of posed bodily expressions (Ruffman et al., 2009; Schlegel et al., 2014). Within the last decade, researchers have begun to address this problem by creating tests that involve dynamic, multimodal emotion recognition, such as the Multimodal Emotion Recognition Test (MERT; Bänziger, Grandjean, & Scherer, 2009) and the Geneva Emotion Recognition Test (GERT; Schlegel et al., 2014).

The GERT comprises 83 brief video clips in which actors portray different emotions, including the basic emotions (e.g., fear, anger, and sadness) in addition to some more complex emotions (e.g., pride, anxiety, and pleasure). After each video clip, participants are presented with 14 possible emotion labels and are required to click the emotion label that best matches the actor's emotional portrayal. The creators of the GERT also created a briefer version, the Geneva Emotion Recognition Test (GERT-S), which includes only 42 items (Schlegel & Scherer, 2016). Since the video clips within these tests integrate multiple modalities (e.g., voice, body language, and facial expressions), the emotional expressions may be more ecologically valid than previous emotion recognition tests (Schlegel & Scherer, 2016). However, although Schlegel and colleagues (2014) found a negative correlation between age and emotion recognition ability on the GERT for adults aged 18-65, neither the GERT nor the GERT-S has been tested on older adults aged over 65 years.

Recently, Holland and colleagues (2018) also modified the static stimuli from their FACES database to create the Dynamic FACES database, with faces that morph from a neutral expression to an expression of one of six emotions: happiness, anger, fear, sadness,

disgust, or neutrality. They then conducted a study that compared young, middle-aged, and older adults' accuracy at recognising emotions expressed by these newly developed Dynamic FACES stimuli. The authors found that older adults were less accurate than young and middle-aged adults at recognising anger, but that older and middle-aged adults were *better* than young adults at identifying sadness. Furthermore, older adults performed as well as middle-aged and young adults at recognising happiness, disgust, neutrality, or fear. These results indicate that using more dynamic and naturalistic stimuli may reduce the age differences previously seen on emotion recognition tasks.

Age-related differences in emotion recognition using dynamic and/or multimodal paradigms remain largely understudied. It is possible, then, that the lack of context in previous studies – especially the integration of facial expressions, voice, and body language – may account for some of the differences observed in emotion recognition between younger and older adults.

The Effects of Stereotype Threat on Stereotype-Relevant Tasks

Researchers have attempted to explain age-related differences in emotion recognition ability using a number of different theories, such as the positivity bias, general cognitive decline with healthy aging, and changes in neural structures involved in recognising emotions (Ruffman et al., 2008). Furthermore, they have suggested that additional factors may contribute to these age differences, such as an own-age bias (Holland et al., 2018) or an absence of context in emotion recognition paradigms (Noh & Isaacowitz, 2013). However, there is another important factor that could partially explain age-related differences in emotion recognition ability. Namely, widely-held negative stereotypes about aging and about older adults' cognitive abilities might have a powerful, negative effect on older adults' ability to recognise emotions.

Stereotype threat refers to a phenomenon whereby people who belong to a minority or stigmatised group (such as African-Americans, females, or older adults) experience impairments on relevant tasks when negative stereotypes about their group are emphasised (Spencer et al., 2016). As part of Steele and Aronson's (1995) seminal research on stereotype threat, they investigated the effects of highlighting negative stereotypes about African-Americans' scholastic performance on their test performance, since African-Americans are often expected to have lower academic ability compared to white students. African-American and white students were given a difficult verbal test, prior to which they were either required or not required to write their race on the cover of the paper. The authors found that, whereas African-American students performed as well as white students when their race was not requested (after controlling for differences in self-reported aptitude scores), they performed significantly worse than white students when instructed to provide their race. The authors concluded that simply making race salient prompted African-American students to conform to racial stereotypes, thus decreasing their performance on the test.

Steele and Aronson (1995) also demonstrated these effects simply through framing the same test in a way that would elicit relevant stereotypes about African-Americans' test performance. In one condition, they informed white and African-American students that the test was diagnostic of intellectual ability, which is stereotypically believed to be lower in African-Americans. In another condition, they told participants that the test was non-diagnostic of ability and framed it simply as a problem-solving task. The results revealed that simply framing the test as diagnostic of intellectual ability was enough to cause a decline in African-American students' performance on the task. A meta-analysis corroborated these early findings that reminding minorities (such as African-Americans) of

stereotypes about their intellectual ability leads to a reduction in performance on relevant tasks (Nguyen & Ryan, 2008).

Stereotype threat effects are not limited to race. Similar detrimental effects of stereotypes on women's task performance have also been demonstrated, particularly for task domains in which men are believed to be more competent. In one study, women and men who were proficient at mathematics were presented with a difficult math test (Spencer, Steele, & Quinn, 1999). In a stereotype-relevant condition, the researchers informed participants that men and woman had previously differed in performance on the test, whereas in a stereotype-irrelevant condition, they implied that men and women usually performed equally. Interestingly, women obtained lower scores than men on the test in the first condition but performed equally to men when stereotypes about women's math performance were rendered irrelevant to the task.

Similarly, Schamder (2002) found that, when students were told that men and women's scores on a math test would be compared, women who identified strongly with their gender performed worse than men, whereas women who did not identify strongly with their gender performed equally to men. These deleterious effects of eliciting stereotypes on women's math performance have been shown to be reliable and robust (Doyle & Voyer, 2016; Nguyen & Ryan, 2008). Further, effects on women's performance in other stereotype-relevant task domains have also been established. For example, a meta-analysis indicated that stereotype threat has a reliably negative effect on women's sport performance, especially for sports in which males are typically believed to perform better (Gentile, Boca, & Giammusso, 2018).

Stereotype threat leads to a feeling that one is at risk of confirming negative perceptions and beliefs about a group that they belong to (Steele & Aronson, 1995). According to Steele's (2010) account, individuals do not even need to endorse or believe

the stereotypes to be true – they merely need to identify with the group to which the stereotype refers. This then leads to a feeling of added pressure to do well in the required domain in order to avoid confirming the negative stereotypes about their group (Spencer et al., 2016). As a consequence of this extra pressure, many people succumb to a self-fulfilling prophecy, whereby their behaviour or cognitive performance confirms these stereotypes (Jussim, Eccles, & Madon, 1996). The effects of stereotype threat when tested in the laboratory have been found to be robust, and are usually moderate to small (Lamont et al., 2015; Spencer et al., 2016).

Stereotype threat is distinct from simple priming in that, in the former but not the latter, reminding people about stereotypes regarding a specific group should only have negative effects on members of that group (Steele, Spencer, & Aronson, 2002). Targets of a stereotype not only possess the knowledge that a stereotype exists (e.g., “women are worse than men at mathematics”), but also understand that they are a part of that stigmatised group (e.g., being a woman). As described by Jamieson and Harkins (2012), it is this “knowing and being” that leads to stereotype threat (p. 292). In other words, the stereotype must be self-relevant in order to provoke stereotype threat. Unlike priming, stereotype threat stems from the knowledge that one is a part of a particular group and that one might confirm negative stereotypes about that group (Jamieson & Harkins, 2012).

Mediators and Moderators of Stereotype Threat

Numerous researchers have explored potential mechanisms through which stereotype threat may reduce performance in different areas. As previously noted, stereotype threat likely leads to the extra pressure to disconfirm – or at the very least, avoid confirming – the negative stereotype (Spencer et al., 2016). Some researchers claim that this pressure may lead to the experience of anxiety, which subsequently disrupts performance (Steele, 2010; Wheeler & Petty, 2001). As Steele (2010) explained, those

being threatened “know at some level, that they are in a predicament: their performance could confirm a bad view of their group and of themselves, as members of that group” (p. 59). Thus, those being threatened may experience anxiety, which undermines their performance, especially in cognitive tasks such as memory recall (Lamont et al., 2015). This is thought to occur through processes such as distraction derived from anxious thoughts, declines in attention, and reduced cognitive capability (Osborne, 2007).

Multiple studies have corroborated this theory. Osborne (2007) conducted a study in which girls and boys completed two mathematics tests in either a high stereotype threat condition, in which they were told that “girls consistently do worse than boys” on the tests, or in a low stereotype threat condition, in which they were told that “these two tests have never shown gender differences” (p. 143). As the participants completed the task, physiological measures of anxiety (skin conductance, blood pressure, and skin temperature) were measured. It was found that girls performed much worse than boys on the task in the high-threat condition, but that girls and boys performed equally well in the low-threat condition. Moreover, it was found that the physiological reactance of girls in the high-threat condition was significantly more pronounced (e.g. increase in skin conductance, decrease in surface skin temperature, and increase in diastolic blood pressure) compared to males in the high-threat condition, and males and females in the low-threat condition.

Another study provided further support for Steele’s (2010) claim that anxiety explains the link between stereotype threat and reduced task performance. Lu and colleagues (2015) found that stereotype threat indirectly led to poorer performance in females on a mathematics task, and that this link was mediated by self-reported anxiety. Furthermore, the link between stereotype threat and performance was also mediated by *mind wandering*, which refers to an individual engaging in thoughts unrelated to the task.

The mediation effects of anxiety and mind wandering were independent of each other, suggesting that stereotype threat produces both anxiety and mind wandering in stigmatised individuals which, in turn, impairs their task performance. Although the independence of these mediation effects fails to demonstrate causality between anxiety and mind wandering, Lu et al. (2015) suggested that anxiety may lead to the avoidance of processing of threatening stimuli.

Tempel and Neumann (2014) investigated whether an interplay between enduring trait test anxiety and stereotype threat may affect women's performance on a mathematics task. In this study, women were presented with a mathematics test in either a 'stereotype denial' condition (told that the stereotype about women being poorer than men at mathematics is incorrect) or a 'stereotype threat' condition (stereotype not mentioned in order to elicit the stereotype subtly). In both conditions, the women were asked to indicate their gender. A measure of test anxiety was used to assess the women's trait (or chronic) anxiety about taking tests. Participants' fear of the test was also measured immediately prior to the mathematics task, in order to measure their state (or situational) anxiety about taking the test. The results demonstrated that, whereas participants with high chronic test anxiety had low performance regardless of condition, participants with low chronic test anxiety performed less well in the stereotype threat condition than the stereotype denial condition. Equivalent results were found for state anxiety. Thus, stereotype threat only negatively influenced performance for those women who were low in test anxiety, effectively reducing their performance to the equivalence of women who were high in test anxiety. These results indirectly support the idea that stereotype threat may impair performance via similar mechanisms to test anxiety.

However, research about anxiety as the main underlying mechanism of stereotype threat is mixed, with some other studies failing to demonstrate that anxiety mediates the

effects of stereotype threat on task performance (Hess, Hinson, & Hodges, 2009; Keller & Dauenheimer, 2003). Other research has shown that anxiety does underlie stereotype threat to an extent, but that it may be just one of many mediators of stereotype threat (Chung, Ehrhart, Holcombe-Ehrhart, Hattrup, & Solamon, 2010; Lu et al., 2015; Mrazek et al., 2011).

Another of the most prevalent theories attempting to explain the underlying mechanisms of stereotype threat is the cognitive load hypothesis (Schmader, Johns, & Forbes, 2008), which places more focus on the disruption of cognitive processing. The cognitive load hypothesis purports that, in accordance with the original suggestions of Steele and Aronson (1995), eliciting stereotypes about a target group leads its members to feel highly motivated to disconfirm the stereotype. Consequently, working memory and other cognitive resources are preferentially devoted to avoiding failure on the task and regulating feelings of frustration, which interrupts an individual's ability to complete the test items successfully (Schamder et al., 2008).

Findings from various experiments have supported this hypothesis. Schmader and Johns (2003) investigated whether stereotype threat did in fact lead to lowered working memory capacity in women on a stereotype-relevant task (a mathematics test). In this study, male and female participants were assigned either to a stereotype threat condition, in which the experimenter specifically related the task to mathematics and mentioned gender differences in mathematic ability, or to a control condition, in which the experimenter simply described the task as assessing working memory capacity. Male and female participants were then required to solve mathematical equations while simultaneously attempting to hold words in memory. The number of words recalled was used as a measure of working memory capacity. In line with the authors' hypotheses,

stereotype threat had a detrimental effect on the female participants' working memory capacities.

Croizet et al. (2004) further investigated the idea that cognitive interference due to heightened mental workload would reduce performance on a task of intellectual ability. The authors recruited college students with either a psychology major or a science major to take part in the study and assigned them to one of two conditions, in which a cognitive test (Raven Advanced Progressive Matrices Test; Raven, 1962) was framed as either diagnostic or non-diagnostic of intellectual ability. It was hypothesised that, due to common stereotypes in France regarding psychology students being less intelligent than science students, framing a task as assessing intelligence would produce stereotype threat in psychology majors. While participants took the cognitive test, experimenters measured their Heart Rate Variability (HRV). HRV was used as a measure of mental load (with decreases reflecting increased mental load), as it has been shown to be a sensitive psychophysiological indicator of cognitive workload (Scerbo et al., 2001). Croizet and colleagues (2004) found that psychology majors experienced a disruptive mental load due to stereotype threat, and consequently exhibited poorer performance. Other research has since corroborated the idea that cognitive load is responsible for stereotype threat effects (e.g., Rydell, van Loo, & Boucher, 2014).

Research has also been conducted to investigate whether particular coping mechanisms or dispositional factors of an individual might moderate the effects of stereotype threat on performance. In one study, the possible moderating effect of sense of humour on stereotype threat was investigated (Ford, Ferguson, Brooks, & Hagadone, 2004). Women completed a mathematics test under one of two conditions. In the stereotype-threat condition, the experimenter described the test as a mathematics task that usually produces gender differences, whereas in the no-stereotype-threat condition, the test

was framed as a problem-solving task on which men and women usually perform equally. As expected, women performed worse in the stereotype-threat condition than in the no-stereotype-threat condition. In the stereotype threat condition only, there was a positive relationship between participants' coping sense of humour and their performance on the maths task. Thus, women who were higher in coping sense of humour did not show the typical response of reduced performance on a mathematics task in response to stereotype threat. Furthermore, in the stereotype threat condition, the relationship between coping sense of humour and math performance was mediated by state anxiety, suggesting that having a good sense of humour protected women from the anxiety that may result from stereotype threat. The authors suggested that perhaps such women viewed the task as a challenge, as opposed to a serious threat.

Von Hippel and colleagues (2005) proposed that certain people might utilise denial as a way of coping with stereotype threat. Specifically, they suggested that particular individuals might preserve their integrity by either denying that the negative stereotype is true, or denying that the stereotype is relevant to themselves. The authors hypothesized that people might be more likely to use denial as a coping strategy if they are high in chronic impression management – in other words, if they consistently emphasise their positive characteristics but deny their negative traits in order to portray a positive image to others. Over four different studies, von Hippel et al. (2005) investigated the relationship between stereotype threat, denial of the stereotype, and level of impression management in different groups (including African-Americans, older adults, and temporary employees). The analyses revealed that, when faced with stereotype threat, participants were more likely to deny incompetence in the stereotype-relevant domain (e.g., that older adults are cognitively inept) if they were more concerned about impression management.

Another study looked at the role of ‘defensive pessimism’ in stereotype threat effects (Perry & Skitka, 2009). Defensive pessimism was defined as when an individual ruminates about all the negative things that could go wrong in a particular situation or task, and sets lower standards for themselves than what they have achieved in the past. According to Perry and Skitka (2009), defensive pessimism is a strategy used to cope with academic stress, and is actually as effective as optimism or positive thinking. The authors found that women who were high in defensive pessimism performed *better* under high than low stereotype threat conditions on a difficult math test, whereas women who were low in defensive pessimism performed worse under high than low stereotype threat conditions. The authors suggested that ruminating may be a strategy to reduce anxiety for defensive pessimists, which may then reduce possible interfering effects of anxiety on performance.

The difficulty of the stereotype-relevant task may also moderate stereotype threat effects. If the cognitive load hypothesis is correct, then performance on a task should be impaired by stereotype threat to a greater degree when the task requires a high level of cognitive resources, compared to tasks that require a lower level of cognitive resources (Nguyen & Ryan, 2008). Nguyen and Ryan’s (2008) meta-analysis indicated that test difficulty does appear to moderate stereotype threat effects on task performance, such that more difficult tasks are associated with larger effects.

Another important factor that may moderate the effects of stereotype threat on task performance is the degree of identification with the relevant task domain. It is possible that only those who actually care about performing well on a task (and thus identify strongly with the task domain) are affected by stereotype threat (Steele, 1999). Indeed, Nguyen and Ryan’s (2008) meta-analysis found that, compared to women who identified strongly with the subject of mathematics, women who had low identification with mathematics were less

affected by stereotype threat relating to math performance (Nguyen & Ryan, 2008).

However, the meta-analysis also revealed an interesting finding whereby highly-identified women were less affected by stereotype threat than moderately-identified women. Nguyen and Ryan (2008) suggested that this may be a result of highly-identified women displaying stereotype reactance, whereby explicit stereotype threat cues lead some individuals to defensively perform *better* on a task (Kray, Thompson, & Galinsky, 2001).

Kray and colleagues (2001) first introduced the idea of stereotype reactance as an extension of ‘psychological reactance’, whereby people respond to perceived threats to their freedom with even greater assertion of their freedom (Brehm, 1966). For example, in the common case of a parent trying to tell a young child which clothes they should wear to school, the child may feel that the freedom to choose his or her own clothes is being threatened; thus, they may demonstrate reactance (Miron & Brehm, 2006). The phenomenon of psychological reactance is also apparent in the famous play by William Shakespeare, *Romeo and Juliet*, in which Romeo and Juliet’s families’ vehement disapproval of their partnership causes them to fall even deeper in love.

With regards to stereotype threat, reactance against negative stereotypes may occur instead of confirmation under particular circumstances. Kray and colleagues (2001) posited that psychological reactance may be experienced when people are blatantly told that they will not perform well in a task as a consequence of their group membership, as opposed to when stereotypes about their group are invoked more subtly (such as framing a task in a particular way that favours one group over another, or reminding participants of stereotypes related to their abilities). Specifically, Kray et al. (2001) investigated whether blatant versus subtle stereotype threat manipulations would lead to different effects on women’s performance on a negotiations task, compared to men (who are widely believed to have superior negotiations skills). It was hypothesised that overtly telling women that

they were expected to perform worse than men on a negotiations task would actually enhance their performance through stereotype reactance. On the other hand, women's performance was hypothesised to be poorer than that of men in response to a more subtle stereotype activation (i.e., simply framing the task as assessing negotiation skills), in line with the theory of stereotype threat. These hypotheses were indeed supported, showing that women reacted against the stereotype that was blatantly evoked and consequently performed better than men, but confirmed the stereotype when it was activated more subtly, performing worse than men.

In line with Kray and colleagues' (2001) findings, it has been suggested that subtle stereotype threat manipulations might be more effective than blatant, fact-based manipulations due to increased ambiguity about the accuracy of the stereotypes (e.g., are women truly worse than men at math?), which might subsequently divert an individual's attention and focus to the stereotype (Lamont et al., 2015). As a result of an increase in distracting thoughts about the stereotype, one may experience a disruptive cognitive load (Schmader et al., 2008), resulting in deleterious stereotype threat effects (Lamont et al., 2015).

Effects of Negative Stereotypes on Older Adults' Abilities

Stereotype threat has not only been shown to affect people of a particular race or gender, but also affects older adults' abilities. There are numerous negative stereotypes associated with aging. Meta-analyses have consistently found that people hold more negative attitudes towards older people than younger people (Kite & Johnson, 1988; Kite, Stockdale, Whitley Jr., & Johnson, 2005; North & Fiske, 2012). Negative attitudes and stereotypes commonly held include that attractiveness declines with age, that older adults are less competent than young adults, that older adults lack creativity, and that they are

less able than young people to learn new skills (Hummert, Garstka, Shaner, & Strahm, 1994; Kite et al., 2005; Swift, Abrams, & Marques, 2013). Furthermore, it is often expected that older people will – at least to some extent – be lonelier (Pikhartova, Bowling, & Victor, 2016), that aging involves reductions in physical health (Robertson, Savva, King-Kallimanis, & Kenny, 2015), and that cognitive processes decline later in the lifespan (Lamont et al., 2015). Widespread ageism and negative stereotypes about age-related declines have been found even in Eastern cultures, where people are traditionally expected to hold their elders in high regard (North & Fiske, 2015).

Indeed, many expectations about aging are accurate to an extent; for example, aging is well known to be associated with physiological, cognitive, and some social declines. However, these deficits are often exacerbated by the extent to which one endorses age-related stereotypes (Wurm, Warner, Ziegelmann, Wolff, & Schüz, 2013) and the effects of stereotype threat (Lamont et al., 2015). Unlike an individual's race or gender, which (in most cases) remain stable across their lifetime, the age group to which they belong is constantly changing. This makes ageism unique compared to racism or sexism, as nearly everybody from the ingroup (i.e., young adults) is highly likely to eventually join the outgroup (i.e., older adults; Cuddy & Fiske, 2002). Further, ageism appears to be less condemned or challenged by society compared to other "isms" (Cuddy & Fiske, 2002), and can function implicitly, or without one's conscious awareness (Levy & Banaji, 2002; Levy, 2003). Thus, negative aging stereotypes that one might endorse as a young adult are likely to be strongly reinforced and internalised by the time one becomes an older adult (Levy, 2003). This suggests that older adults' abilities might be affected by both their own self-stereotypes as well as stereotype threat.

A number of studies have supported the hypothesis that older adults' abilities and wellbeing are negatively affected by their own self-stereotypes. Pikhartova and colleagues

(2016) investigated whether people who believe old age to be a period of loneliness and think they will become lonelier with age actually experience more loneliness in later life than those who do not endorse these stereotypes. The authors' findings demonstrated that agreeing with the statements, "As I get older I expect to get more lonely," and, "Old age is a time of loneliness" was strongly associated with actual reported loneliness within the following 8 years, even when other variables such as depression, self-perceived age, and marital status were adjusted for.

Another study investigated whether negative perceptions of aging were related to walking speed in middle aged and older adults (Robertson et al., 2015). Adults aged over 50 were given the Aging Perceptions Questionnaire (B-APQ), on which they rated their agreement with positive items such as, "As I get older I continue to grow as a person", and negative items such as, "Slowing down with age is not something I can control".

Participants also completed two Timed Up-and-Go (TUG) tasks – one as a baseline, and one at a follow-up two years later. The TUG task involved timing how long it took each participant to get up out of a chair, walk 3 metres at their usual pace, and walk back to sit down again. The results demonstrated that, even when controlling for baseline TUG and multiple other covariates, participants who had greater negative perceptions about aging had a greater decline in walking speed at follow-up than those with fewer negative perceptions. These studies indicate that older adults' self-stereotypes about aging can have a negative effect on relevant tasks.

However, older adults do not necessarily have to endorse negative stereotypes about aging in order to be affected by them. More central to the current research is the role of age-related stereotype threat, whereby older adults are simply reminded of commonly held negative aging stereotypes, on various processes and abilities. In one study, young and older adults were randomly assigned to either a positive or negative stereotyping

condition, in which they were presented with scientific evidence that either disconfirmed or supported negative stereotypes about aging, respectively, or to a control condition that did not involve the presentation of any evidence (Hess, Auman, Colcombe, & Rahhal, 2003). The results showed that older participants in the negative stereotyping (i.e. stereotype threat) condition performed more poorly on a memory recall task, compared to younger participants, and also to older participants who were in the positive or control conditions. This indicated that simply making negative aging stereotypes salient was sufficient to produce performance decrements.

Another study by Swift, Lamont, and Abrams (2012) investigated whether stereotype threat via comparisons with young adults would impact older adults' hand grip strength. Before testing older adults' hand grip, half of the participants were informed that the goal of the study was to compare older and young adults' performance on various tasks, and that both older and young adults would be taking part in the study. In the control condition, participants were simply told that the purpose of the study was to see how people perform on different tasks. Indeed, the results showed that older adults' performance on the hand grip strength task reduced by approximately 50% in the stereotype threat condition, compared to control. These results suggest that social comparisons with young adults can impair older adults' performance even on a simple, objective task of physical strength.

Stereotype threat has also been shown to impair older adults' performance on cognitive tests commonly used to screen for predementia (Mazerolle et al., 2017). In one study, older adults were assigned to either a threat or a reduced-threat condition (Mazerolle et al., 2017). In the threat condition, participants were informed that memory was being assessed and that both young and older adults were participating. In the reduced-threat condition, participants received the same instructions but were told that young and older

adults usually perform equally well on the tests. The participants were then tested on both the Mini Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) and the Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005). The authors found that older adults were more likely to meet criteria for a mild cognitive impairment in the threat condition (40% of participants) than in the reduced-threat condition (only 10% of participants). This finding has significant implications for the testing of older adults' cognitive abilities in real-world environments and highlights the importance of minimising stereotype threat in settings where such testing takes place.

One stereotype threat manipulation used by Desrichard and Köpetz (2005) involved framing a task in a way that was stereotype-relevant to older adults (i.e., would rely on an ability that is expected to decline with age) versus framing it in a way that would not elicit negative stereotypes about aging. Participants were asked to complete a "running an errand" task (Radziskewska & Rogoff, 1991), which involved memorising a list of shop items and then, without viewing the list, using a map to work out the quickest way of getting from shop to shop to purchase each item. Before completing this task, participants were either told that the task relies on memory skills (which was expected to produce stereotype threat in older adults), or that it relies on orientation skills. The authors found that older adults' performance on the errand task was much poorer when it was framed as a memory task, compared to when it was framed as an orientation task. In contrast, young adults' performance did not differ between the two conditions. These results suggested that making the task relevant to stereotypes about age-related memory decline led to feelings of stereotype threat in older adults, which subsequently further impaired their memory performance.

Age-related stereotype threat has now been demonstrated by numerous studies to affect older adults' performance within many different task domains. Stereotype threat has

been shown to reduce older adults' self-reported hearing (Barber & Lee, 2016), their driving ability and confidence (Chapman, Sargent-Cox, Horswill, & Anstey, 2016; Lambert et al., 2016), and their learning of maps (Meneghetti et al., 2015). Lamont and colleagues (2015) conducted a review and meta-analysis of the effects of age-related stereotype threat on memory, cognitive, and physical processes in older adults. The analysis, which included 22 published and 10 unpublished articles, demonstrated a robust and significant small-to-medium effect of age-related stereotype threat (Lamont et al., 2015). This research was further corroborated by a subsequent meta-analysis, which demonstrated that age-related stereotype threat reliably reduced older adults' episodic and working memory (Armstrong et al., 2017).

In addition, Lamont and colleagues (2015) found that older adults were more susceptible to age-related stereotype threat when studies used stereotype-based manipulations (e.g. using subtle cues such as comparing age groups, or informing participants that older adults are widely believed to be worse at the task) as opposed to fact-based manipulations (e.g. telling participants that there is evidence to show that memory performance declines with age). As previously described, more blatant, fact-based manipulations occasionally lead to the phenomenon of stereotype reactance, whereby people attempt to disprove the evidence that they have been given, and deliberately engage in behaviour contrary to the stereotype (Kray et al., 2001; Lamont et al., 2015).

Another way that performance may be enhanced rather than impaired by stereotypes is a potential "stereotype boost" effect, produced by evoking *positive* stereotypes about aging. Swift and colleagues (2013) investigated whether invoking positive stereotypes causes older adults to perform better on cognitive tasks. Indeed, there are many positive characteristics associated with aging, with older adults often being perceived to be wiser, more knowledgeable, and to have more life experience than young

adults (Swift et al., 2013). Thus, Swift and colleagues (2013) emphasised these characteristics in a stereotype boost condition, telling older adults that, “It is widely assumed that experience and wisdom increases with age so that people become better at solving all kinds of everyday practical problems” (pp. 26). They also included a typical stereotype threat condition – in which they told participants that it is widely assumed that cognitive performance declines with age – as well as a control condition.

Participants were then tested on a battery of cognitive tasks, including tasks that assessed working memory, as well as a crossword puzzle – a task on which older adults are often assumed to perform well. It was found that the stereotype threat condition led to decreased performance compared to the control condition, on both the cognitive tasks and the crossword puzzle – an effect that was mediated by anxiety. In contrast, the stereotype boost condition led to augmented performance on the crossword puzzle. However, the boost condition did not increase performance on the cognitive tasks. It is possible that enhancing older adults’ performance by invoking positive stereotypes is only successful for task domains in which older adults are expected to be competent.

Shapiro and Neuberg’s Multi-Threat Framework

The way in which stereotype threat is experienced may differ depending on both the situation, and who is experiencing the threat. A female taking a mathematics test may differ from an older adult taking a test of cognitive ability with regard to the extent to which the stereotype threat interferes with their performance on these tasks, the underlying mechanisms of stereotype threat, and the factors that moderate the effect of stereotype threat on performance (Nguyen & Ryan, 2008; Barber, 2017). Indeed, Nguyen and Ryan’s (2008) meta-analysis demonstrated that, when tasks were difficult, reductions in test performance due to stereotype threat were smaller for women than for racial minorities. For women, task performance was most affected by subtle stereotype threat manipulations,

followed by blatant and moderately explicit threat manipulations, whereas minorities' performance was most affected by moderately explicit threat manipulations, followed by blatant and subtle manipulations. Therefore, while many researchers discuss stereotype threat as though it were a stable phenomenon that works via the same mechanisms for different stereotyped groups and across various tasks, it may not be so clear-cut (Nguyen & Ryan, 2008).

In an attempt to conceptualise and explain the existence of multiple forms of stereotype threat, Shapiro and Neuberg (2007) proposed a multi-threat framework involving six qualitatively different types of stereotype threat: Self-concept threat, Group-concept threat, Own-reputation threat (outgroup), Group-reputation threat (outgroup), Own-reputation threat (ingroup), and Group-reputation threat (ingroup). These six types of stereotype threat are the result of two factors: 1) whether an individual is worried about confirming stereotypes about themselves personally, or their group as a whole (i.e. threat target), and 2) whether an individual is worried about judgement from themselves, the outgroup, or the ingroup (i.e. threat source). Table 1 outlines the possible types of stereotype threat according to Shapiro and Neuberg (2007), and includes descriptive examples of each type using the illustrative case of a female taking a mathematics test under stereotype threat.

Table 1.

Six Qualitatively Different Types of Stereotype Threat (Depending on the Perceived Target and Source of the Threat; Shapiro & Neuberg, 2007)

Type of Stereotype Threat	Threat target	Threat source	Example
Self-concept threat	Self	Self	A female worries that, if she performs poorly on a maths test, it will confirm to <i>herself</i> that she <i>personally</i> has the stereotyped trait (poor math ability)
Group-concept threat	Group	Self	A female worries that poor math performance will confirm to <i>herself</i> that the stereotype trait is true of <i>her group</i> (females in general)
Own-reputation threat (outgroup)	Self	Outgroup members	A female worries that poor math performance will confirm to <i>outgroup members</i> (males) that she <i>personally</i> has the stereotype trait, and that this will lead to judgement from males
Group-reputation threat (outgroup)	Group	Outgroup members	A female worries that poor math performance will confirm to <i>outgroup members</i> (males) that the stereotyped trait is true of <i>her group</i> (females), and that this will lead to judgement from males
Own-reputation threat (ingroup)	Self	Ingroup members	A female worries that poor math performance will confirm to <i>ingroup members</i> (other females) that she <i>personally</i> has the stereotyped trait, and that this will lead to judgement from other females
Group reputation threat (ingroup)	Group	Ingroup members	A female worries that poor math performance will confirm to <i>ingroup members</i> (other females) that the stereotyped trait is true of <i>her group</i> (females), and that this will lead to judgement from females against their own group (i.e. conceding that they are indeed worse than males at math)

Although Shapiro and Neuberg (2007) proposed that there are six distinct types of stereotype threat, they do not necessarily occur independently of one another. In some cases, a group member might experience only one of the six types of stereotype threat. For example, if an individual wants to do well on a test for their own benefit and does not care how others perceive them, they might only experience “self-concept” threat. However, it is also possible for a group member to experience two or more (and perhaps even all six) of the stereotype threat types, particularly if they identify strongly with their group and the task domain (Shapiro & Neuberg, 2007).

Building on this multi-threat framework, Barber (2017) argued that the type of stereotype threat experienced by older adults with regard to cognitive decline is likely to be a combination of “self-concept” and “own-reputation” stereotype threat. Most people begin developing and internalising negative stereotypes about aging in childhood but are not threatened by them since they are not relevant to the self (Barber, 2017). People do not become part of the stigmatised older age group until later in life, making this stereotyped trait unique compared to stable traits such as race and gender. This also means that the negative aging stereotypes people have developed from childhood have usually been deeply ingrained by the time they become self-relevant. Therefore, older adults may be particularly vulnerable to “self-concept” stereotype threat, as they should be worried that the negative aging stereotypes they have long endorsed are now true of them personally (Barber, 2017).

In addition, many older adults have low identification with being “old”, and instead usually report feeling younger than they are (Neugarten & Hagestad, 1976; Rubin & Bernsten, 2006; Barber, 2017). Older adults can maintain these subjective feelings of being younger by making downward comparisons with other people their age (e.g., believing their own abilities are better than other ingroup members), and with negative

aging stereotypes (e.g., believing that their abilities are better than is expected according to ageist stereotypes), which can actually result in these stereotypes being reinforced even further (Barber, 2017). Because group identification with the “older” age group is usually low, older adults are less likely to experience “group-reputation threat”, and instead are more likely to experience “own-reputation threat”, where they worry that the negative stereotypes about cognitive decline with age are true of themselves, and may lead to judgment from ingroup or outgroup members. Thus, Barber (2017) concluded that older adults are most likely to experience self-concept, own-reputation stereotype threat when it comes to cognitive ability (although this is not necessarily true for all older adults).

In response to the self-concept, own-reputation stereotype threat that older adults may be most likely to experience, they might preferentially adopt a *prevention focus*, whereby they attempt to avoid taking any risks that may lead to them performing poorly on cognitive tasks (Barber, 2017). Regulation focus theory is premised on people’s innate motivations to approach pleasure and avoid pain, which are implemented as two distinct behavioural foci: promotion and prevention (Higgins, 1997). A promotion focus emphasises advancement and achieving gains, whereas a prevention focus emphasises safety and avoiding losses (Higgins, 1997; Crowe & Higgins, 1997). Barber (2017) suggested that older adults are more likely to adopt such a prevention focus in response to stereotype threat because they become motivated to avoid doing badly and thus confirming negative stereotypes about their group (Barber, 2017).

However, certain tasks are more compatible with either a promotion or prevention focus, and adopting the wrong type of focus can itself lead to poor performance (Barber & Mather, 2013; Higgins, 2000). While rewards-based tasks are more suited to a promotion focus, losses-based tasks are more compatible with a prevention focus (Barber, Mather & Gatz, 2015). Shah, Higgins, and Friedman (1998) demonstrated that people with a chronic

promotion focus performed better than those with a prevention focus on an anagram task framed in terms of gains (i.e. performing well led to a monetary reward), but the opposite was true when the task was framed in terms of losses (i.e. performing well avoided the loss of money; Shah et al., 1998). The compatibility – or lack thereof – between a task and the focus adopted by an individual (either chronically or temporary), is known as regulatory ‘fit’ (Higgins, 2000).

Most cognitive tasks require a promotion focus, due to gains being emphasised (e.g. correctly recalling as many items as possible in a memory test; Barber et al., 2015; Barber, 2017). Therefore, when older adults adopt a prevention focus in response to stereotype threat, in an attempt to avoid confirming negative aging stereotypes, there is often a lack of regulatory fit with the task they are completing (Barber, 2017). In other words, because older adults have switched to a prevention focus on a task that requires a promotion focus, they end up performing poorly, despite the motivation to avoid doing so (Barber, 2017).

Accordingly, changing the task to fit a prevention focus may prevent older adults from performing poorly when aging stereotypes are elicited. Barber and Mather (2013) adapted a memory task so that, in one condition, correct recall led to gains (for each word participants recalled, they received 2 poker chips), and in the other, forgetting led to losses (for each word participants forgot, 3 poker chips were subtracted from an initial 100). In the first task, which fits best with a promotion focus, stereotype threat reduced older adults’ performance, presumably because they switched to a prevention focus, thus diminishing regulatory fit (Barber & Mather, 2013). In the second task, which fits better with a prevention focus, stereotype threat actually improved older adults’ performance because regulatory fit was achieved (Barber & Mather, 2013). Therefore, older adults may

only be affected by stereotype threat when the task has an implicit or explicit promotion focus.

Barber (2017) suggested that this regulatory focus framework might be a better explanation for age-related stereotype threat effects on older adults' cognitive ability, as opposed to mechanisms that have been theorised to underlie race-based or gender-based stereotype threat, such as an increased cognitive load. Barber and Mather (2014) reviewed the mixed research regarding how stereotype threat affects older adults' cognitive abilities. They acknowledged that the research remains inconsistent, and that there were indeed some studies that supported the cognitive load hypothesis in relation to age-related stereotype threat. One study demonstrated that stereotype threat impaired older adults' controlled use of memory, but not their automatic recall (Mazerolle, Régner, Morisset, Rigalleau, & Huguet, 2012). Mazerolle and colleagues (2012) suggested that, as a result of stereotype threat, older adults experienced an increased cognitive load that was detrimental only to memory processes that rely greatly on cognitive resources.

However, Barber and Mather (2014) discussed opposing evidence that cognitive load may not explain age-related stereotype threat effects to the same extent that it explains stereotype threat effects in younger populations. Hess et al. (2009) found no evidence to suggest that stereotype threat affects older adults through increased working memory or load. As part of their study, young-old adults (aged 60-70 years) and old-old adults (aged 71-82 years) completed a computation span task under either stereotype threat conditions, in which participants were informed that the task assessed memory ability and that age differences were being investigated, or a nonthreat condition, in which participants were told that the test was age fair. The results showed that there were no interaction effects involving stereotype threat condition on young-old or old-old adults' working memory performance.

Popham and Hess (2013) reported further evidence for the idea that, whereas stereotype threat might affect young adults via increased cognitive load, stereotype threat might affect older adults via prompting the adoption of a prevention focus when a promotion focus is optimal. In their study, young and older adults were subject to different stereotype threat manipulations prior to completing a letter cancellation task and an operation span task. For young adults, who were students majoring in subjects other than engineering, the threat manipulation involved implying that engineering students would perform better than them on the tasks. For older adults, the threat manipulation involved implying that young adults would have superior task performance to themselves.

With regards to the operation span task, the results demonstrated that young adults' working memory performance was impaired under threat conditions, whereas older adults' working memory was not, supporting the idea that stereotype threat may increase cognitive load for young, but not older, adults. Furthermore, on the letter cancellation task, both young and older adults' performance was affected by stereotype threat (although this effect was far greater for older adults). Older adults' reductions in letter cancellation performance appeared to be consistent with the regulatory focus theory, as their speed on the task was significantly lower and thus reflected a more risk-averse (and possibly prevention-focussed) approach. Of note, however, the same (but weaker) pattern was seen for younger adults.

Taking this previous research into account, Barber (2017) proposed that, rather than increased cognitive load or working memory resources, regulatory focus theory may be the mechanism that underlies age-related stereotype threat effects for most older adults. If her suggestion is correct, and stereotype threat impairs older adults' cognitive abilities by causing them to adopt a prevention focus when a promotion focus is optimal, then stereotype threat might also affect older adults' ability to recognise emotions. Emotion

recognition is a cognitive ability that is known to decline with age (Gonçalves et al., 2018; Ruffman et al., 2008), and that requires a promotion focus in most emotion recognition paradigms, with gains usually being emphasised (i.e. asking participants to correctly label as many emotion expressions as possible).

Indeed, research has supported the idea that emotion recognition may benefit from a promotion focus (Sassenrath, Sassenberg, Ray, Scheiter, & Jarodzka, 2014). Sassenrath and colleagues (2014) were the first to investigate the relationship between regulatory focus and facial emotion recognition. They hypothesized that emotion recognition would be facilitated by a promotion focus, since well-learned skills and tasks (like emotion recognition) usually require less monitoring. In their study, Sassenrath et al. (2014) experimentally manipulated the regulatory focus of undergraduate students. In a promotion focus condition, participants were asked to recall promotion-type successes and failures, whereas in a prevention focus condition, they were asked to recall prevention-type successes and failures. Participants then completed a basic emotion recognition task that required them to label facial expressions of happiness, sadness, fear, and anger. In line with their hypothesis, the authors found that promotion-focused students were more accurate at recognising emotions than prevention-focused students.

Thus, a prevention focus may not be optimal for emotion recognition (Sassenrath et al., 2014), and if raising negative stereotypes about age-related cognitive decline leads older adults to adopt a prevention focus (Barber, 2017), their emotion recognition performance may consequently be further impaired. If this is the case, then age-related stereotype threat might partially explain empirical findings that older adults are less accurate than older adults at recognising emotions. Given that no research has yet investigated this possibility, the primary objective of the current thesis was to discover

whether older adults' emotion recognition, like other cognitive abilities, is affected by age-related stereotype threat.

Summary of the Literature

The ability to recognise emotions from other people's faces, bodies, and voices, is an important cognitive ability that is integral to human social interaction. However, this ability has consistently been shown to decline with age (Gonçalves et al., 2018; Ruffman et al., 2008). Researchers have yet to reach a conclusive answer or consensus about the aetiology of this age-related decline in emotion recognition. It may be caused by one or a combination of a positivity effect, the cognitive decline that occurs with normal aging, neural changes within the brain (Ruffman et al., 2008), an own-age bias (Holland et al., 2018), or the absence of context inherent in many typical emotion recognition paradigms (Noh & Isaacowitz, 2013). However, another factor that may have exaggerated differences in emotion recognition between young and older adults is a well-known phenomenon known as stereotype threat.

Stereotype threat refers to the feeling that one is at risk of confirming stereotypes about a group to which one belongs, which often leads one to suffer impairments on stereotype-relevant tasks (Steele, 2010). Stereotype threat effects have been widely demonstrated in such areas as women's mathematics performance (Doyle & Voyer, 2016), African-Americans' academic test performance (Nguyen & Ryan, 2008), and importantly for the current research, older adults' cognitive abilities (Armstrong et al., 2017; Lamont et al., 2015). Whereas race-based and gender-based stereotype threat effects have been theorised to occur via affective and/or cognitive mechanisms (such as anxiety or cognitive load), age-related stereotype threat might involve different mechanisms (Barber & Mather, 2014). Barber (2017) proposed that stereotype threat causes older adults to adopt a

prevention focus, where they aim to avoid failure, which in turn, leads to impairments on cognitive tasks that require a promotion focus (i.e., aiming to achieve successes). Emotion recognition is one such cognitive ability that, like memory, benefits from a promotion focus (Sassenrath et al., 2014) and declines with age (Ruffman et al., 2008). Thus, it is possible that age-related stereotype threat further impairs older adults' recognition of emotion.

Potential Age-Related Stereotype Threat Effects on Older Adults' Emotion

Recognition Ability: The Present Research and Possible Implications

Eliciting stereotypes about aging has been shown to produce stereotype threat in older adults, which subsequently negatively impacts their performance on stereotype-relevant tasks involving cognition, physical tasks, and memory (Lamont et al., 2015). This empirical finding has important implications both for older adults' everyday life and for laboratory research. Firstly, older adults may frequently be exposed to stereotypes about aging in their daily life, including through the media and through the manner in which other people act towards them. These everyday cues may emulate a stereotype threat effect, consequently worsening age-related cognitive and memory deficits (Hess et al., 2003). On the other hand, this also implies that minimising aging stereotypes and reducing the number of aging cues in an environment may help to preserve certain abilities in older adults (Hess et al., 2003).

Moreover, findings about age-related stereotype threat effects on older adults' memory and cognitive functioning indicate that previous laboratory-demonstrated memory deficits in older adults may have been exaggerated (Hess et al., 2003). Age-related stereotype cues that might reduce older adults' performance are often evident in studies that assess age differences. Simply using task instructions that emphasise abilities that

decline with age (Rahhal, Hasher, & Colcombe, 2001) or informing older participants that they are being compared with younger adults (Abrams et al., 2006) can produce stereotype threat effects. Therefore, it is possible that age-related declines in memory are not as extreme as has been demonstrated in laboratory settings and may partially reflect stereotype threat effects rather than being exclusively due to true age differences.

Another aspect of cognitive functioning that may be susceptible to age-related stereotype threat impairments is emotion recognition ability. The recognition of emotions in faces, body language, and tone of voice, has been empirically demonstrated to decline with age, with older adults reliably performing worse than young adults when recognising anger, fear, sadness, and happiness (Ruffman et al., 2008). However, as with memory and other cognitive abilities, it is possible that age-related differences in emotion recognition ability have been exaggerated by stereotype threat. According to Barber (2017), stereotype threat might lead older adults to adopt a prevention focus, which can impair their performance on cognitive tasks that require a promotion focus (such as emotion recognition; Sassenrath et al., 2014). Thus, raising stereotypes about aging may impair older adults' emotion recognition ability. If this were the case, it would have important implications for past and future laboratory research into older adults' emotion recognition ability.

A potential limitation of many studies that compare young adults and older adults is the participants' knowledge of such comparisons. The mere fact that age differences are being examined in a particular study may be sufficient to evoke stereotype threat. Indeed, numerous studies have used stereotype threat manipulations of which a large (or the only) component is informing participants that young and older adults are being compared (e.g. Abrams et al., 2006; Abrams et al., 2008; Swift et al., 2012). These manipulations were effective in that older adults' performance on cognitive and physical tasks was reduced

when they were informed about the age comparison, compared to control (Abrams et al., 2006; Abrams et al., 2008; Swift et al., 2012).

It follows, then, that studies that have investigated age-related differences on emotion recognition tasks – and have informed their participants of this – may have unknowingly evoked stereotype threat. For instance, in one study that investigated age differences in accuracy and reaction times on an emotion recognition task, participants were first advised that “young and older adult’s perceptual judgements in response to visual stimuli” were being compared (Keightley, Winocur, Burianova, Hongwanishkul, & Grady, 2006). This may have elicited stereotype threat, as it is generally accepted that people’s cognitive faculties decline with age (Lamont et al., 2015). As a consequence, the study’s finding that older adults were poorer than young adults at correctly identifying fear and sadness could possibly have been exaggerated.

If emotion recognition abilities are affected by aging stereotypes, this would also have important implications for older adults’ everyday life. Exposure to frequent cues about aging in their environment – in addition to potentially ageist behaviour from other people – may worsen older adults’ ability to recognise emotions expressed by others, which could have detrimental effects on their capacity to effectively communicate and interact with people in social situations. Such detrimental effects would be significant considering longitudinal research showing that deficits in social connection and engagement in older age are associated with greater cognitive decline (Evans, Martyr, Collins, Brayne, & Clare, 2018; Kelly et al., 2017; Seeman, Lusignolo, Albert, & Berkman, 2001; Zunzunegui, Alvarado, Del Ser, & Otero, 2003).

The overarching objective of the present research was to investigate whether older adults’ emotion recognition ability, like other cognitive abilities, is impaired by age-related stereotype threat. This was explored across three studies. The first study involved

comparing the effects of a stereotype threat manipulation on young (aged 18-30 years) and older (aged over 65 years) adults' emotion recognition ability. Participants were assigned to one of three conditions (two experimental, one control). In both experimental conditions, they were informed that young and older adults were being compared, whereas participants were not told this in the control condition. Furthermore, in an 'older threat' condition, participants were told that older adults are widely believed to be worse at recognising emotions, while in a 'young threat' condition, they were told that young adults are commonly believed to be worse. In the control condition, there was no mention of age-related differences in emotion recognition ability.

Participants completed two tasks; one involving the basic recognition of emotions in faces, and another involving the recognition of complex mental states expressed by photos of eyes. In keeping with prior research, it was expected that older adults would be less accurate than young adults at recognising basic emotions and mental states. More importantly, it was hypothesised that, as a result of commonly held stereotypes that cognitive abilities decline with age, eliciting stereotypes about age-related deficits in emotion recognition would cause older adults to feel threatened. As a result of these feelings of stereotype threat, older adults' emotion recognition accuracy was expected to be reduced. On the other hand, because young adults are not the target of stereotypes about age-related cognitive decline, they were not expected to be threatened by the stereotype threat manipulation (and therefore, their emotion recognition accuracy was expected to remain unaffected).

As will be discussed in depth in upcoming chapters, the stereotype threat manipulation in Study 1 did not have the expected effect on older adults' feelings of threat, nor their emotion recognition ability. This raised questions about whether lay people perceive emotion recognition to be a cognitive task, or whether they view it more as a

social task. If people generally perceive emotion recognition to be a cognitive task, then implying that older adults should be worse at recognising emotions would be expected to produce stereotype threat effects due to stereotypes about age-related cognitive decline (Prohaska, Parham, & Teitelman, 1984; Singer, 1986; Swift et al., 2013). However, if lay people view emotion recognition more as a social task, age-related stereotype threat might not be successful in producing stereotype threat since older adults are often expected to be equally good as young adults in social domains (e.g., Swift et al., 2013). Furthermore, it is possible that there are not widely held beliefs that emotion recognition declines with age, despite the empirical research demonstrating such a decline.

To address these questions, the second study aimed to clarify the current status of age-based stereotypes in a western society (United States of America). The primary aim of this exploration was to discover whether people view emotion recognition more as a cognitive or social task, and whether there is indeed a widely held belief among lay people that emotion recognition deteriorates with age. To my knowledge, there has not yet been any research investigating stereotypes about young and older adults' abilities to recognise emotions. Therefore, young (aged 18-30 years), middle-older (aged 50-64 years), and older (aged over 65 years) adults were asked to complete a questionnaire regarding the competencies of a typical 25-year-old compared to a typical 75-year-old, in a number of skill areas (including emotion recognition, cognitive tasks, and social interaction).

Another objective of the second study was to investigate the effect of participants' *own* perceptions of aging on their emotion recognition ability. Stereotypes that people hold about aging inevitably become self-stereotypes with age, and therefore might negatively affect certain abilities in a similar way to experimentally inducing stereotype threat. Indeed, more negative perceptions about aging have been shown to predict declines in memory and verbal fluency in older adults (Levy, 2003; Robertson, King-Kallimanis, &

Kenny, 2016). Therefore, to investigate whether more negative perceptions about aging were associated with reduced emotion recognition in older adults, participants' perceptions of aging were measured (using the Brief Aging Perceptions Questionnaire; Sexton, King-Kallimanis, Morgan, & McGee, 2014). All participants completed a dynamic, multimodal emotion recognition task (the GERT-S, described previously).

Finally, a third study is reported, which implemented a subtle stereotype threat manipulation based on the prevalent aging stereotypes ascertained in Study 2. Because cognitive abilities are believed to decline with age, it was considered that framing an emotion recognition task as assessing cognitive ability might produce stereotype threat in older adults, consequently disrupting their emotion recognition performance. Previous research has demonstrated that framing tasks as measuring an ability known to decline with age (e.g., memory) can, in fact, negatively affect older adults' performance on relevant tasks (Desrichard & Köpetz, 2005).

In this study, young (aged 18-30) and older (aged over 65) adults were assigned to one of three conditions. In the 'cognitive' condition, participants were informed that the study aimed to assess young and older adults' cognitive abilities. In the 'social' condition, the study was framed as assessing young and older adults' social ability. Finally, in the control condition, participants were given a generalised explanation that the study was assessing different types of people's abilities in various domains. All participants then completed the GERT-S. They also completed a measure of identification with their age group, to see whether the degree of age group identification moderated stereotype threat effects, in line with previous research showing this to be the case (e.g., Deaux et al., 2007; Kang & Chasteen, 2009; Schmader, 2002).

It was expected that framing emotion recognition as a cognitive task would produce feelings of stereotype threat in older adults, which would in turn impair their

emotion recognition ability. In contrast, it was hypothesised that older adults would not feel threatened in the control condition, nor in the social condition since many social abilities are believed to be preserved over the lifespan (Blanchard-Fields, 2007; Swift et al., 2013). As a result, it was expected that emotion recognition ability would remain unaffected in these conditions. It was also considered possible that age group identification might moderate the hypothesised effects in this study.

As in the first study, it was expected that, because young adults are not the target of negative aging stereotypes about cognitive or social decline, their self-reported threat concerns and emotion recognition performance would not differ between conditions. In the same vein, it was also expected that age group identification would not have any effect (moderating or otherwise) on young adults' emotion recognition performance. The following three chapters provide further detail on each study conducted as part of this thesis and summarise the results of each. The final chapter includes a full discussion of the integrated results and their implications.

CHAPTER TWO

Study One: The Effect of Stereotype Threat on Older Adults' Emotion Recognition Ability

Humans inevitably experience declines in physical functioning, memory, and cognitive ability with age. However, these age-related declines can be exacerbated by stereotype threat, whereby eliciting stereotypes about a certain group often leads to its members experiencing performance deficits on relevant tasks (Steele, 2010). Generally, people believe that older adults have worse cognitive ability than young adults (Prohaska et al., 1984; Singer, 1986; Swift et al., 2013), and this belief can further impair older adults' performance across a range of cognitive tasks. Indeed, Lamont and colleagues' (2015) meta-analysis demonstrated a significant and robust effect of age-related stereotype threat on older adults' performance on various memory and cognitive tasks, including mathematics, letter cancellation, and mental rotation.

To date, no research has considered the effects of stereotype threat on another cognitive ability that is subject to decline with age – emotion recognition. The ability to recognise emotions, particularly from facial expressions (but also from body language and tone of voice), has been shown to decline in adults aged over 60 (Ruffman et al., 2008). Older adults are significantly worse than young adults at recognising anger, fear, and sadness, in particular (Gonçalves et al., 2018; Ruffman et al., 2008). Emotion recognition is a complex cognitive task that involves attention, perception, evaluation, and labelling of emotional expressions (Adolphs, 2002). As older adults are generally believed to be worse

than young adults on cognitive tasks, it is highly plausible that eliciting stereotypes about age-related declines in emotion recognition may lead to older adults performing worse at recognising facially-expressed emotions.

The present study aimed to explore the potential effects of stereotype threat on older adults' emotion recognition ability using a stereotype threat manipulation based on the method implemented by Swift et al. (2013). Young adults (aged 18-30 years) and older adults (aged over 65 years) were assigned to one of three stereotype threat conditions: 'older threat', 'young threat', or control. Participants in the 'older threat' condition were told that "it is widely believed that the ability to recognise emotions *declines* with age" and that "the purpose of this study is to see whether older people do perform more poorly on emotion recognition tasks than young people." Participants in the 'young threat' condition were told that "it is widely believed that the ability to recognise emotions *increases* with age," and that the aim of the study was to "see whether older people do perform better on emotion recognition tasks than young people." In the control condition, there were no references to comparing young and older adults or investigating age differences in emotion recognition.

Before completing the emotion recognition tasks, participants' state anxiety was measured with the brief state scale of the Spielberger State-Trait Anxiety Inventory; Marteau & Bekker, 1992), as situational anxiety caused by stereotype threat is one possible mechanism underlying performance deficits on stereotype-relevant tasks (e.g., Abrams et al., 2006). All participants then completed a basic emotion recognition task, which involved selecting an emotion label (from five options: disgust, anger, sadness, fear, happiness) that best described the emotion expressed by a number of young and older faces. Given that previous research has shown that older adults may have compromised theory of mind, participants also completed the Reading the Mind in the Eyes Test

(RMET; described in the General Introduction). Following these tasks, participants were asked two questions to measure how threatened they had felt (“Were you worried that your ability to perform well on these tasks was affected by your age?” and “Were you worried that if you performed poorly on the test, the researcher would attribute your poor performance to your age?”; see Gaillard, Desmette, & Keller, 2011).

Because older adults are generally expected to be worse than young adults at completing cognitive tasks, and have been shown to be poorer at recognising emotions, it was hypothesised that mentioning stereotypes about age-related declines in emotion recognition would cause older adults to report heightened levels of stereotype threat, and possibly increased state anxiety. As a consequence, it was expected that they would experience performance deficits on the emotion recognition task and RMET. Specifically, it was hypothesised that older adults would exhibit higher levels of stereotype threat and state anxiety, but lowered accuracy on the emotion recognition task and RMET, in the ‘older threat’ condition compared to the ‘young threat’ and control conditions.

In contrast, it was hypothesised that young adults’ performance on the basic emotion recognition task would not be affected by stereotype threat condition. In order to elicit feelings of stereotype threat, the target must be a part of the stigmatized group and must be aware of the relevant stereotypes about them (Steele, 2010). Because young adults are expected to be superior to older adults when completing cognitive tasks, and are better than older adults at recognising emotions, they should theoretically be immune to the stereotype threat manipulation. Specifically, it was hypothesised that young adults’ overt reports of stereotype threat, self-reported state anxiety, and their performance on the emotion recognition task and RMET, would remain consistent across the three conditions.

Method

Participants

After exclusion criteria were applied (see Results section), the participants included 72 young adults (38 male) aged 18-29 ($M = 20.61$ years, $SD = 2.26$ years) and 83 older adults (42 male) aged 65-90 ($M = 72.43$ years, $SD = 4.98$ years). Young participants were recruited through the University of Otago's Psychology Research Participation website and were reimbursed \$15 for their out-of-pocket and travel expenses, or participated to satisfy a small part of their first- or second-year Psychology course assessment at University of Otago. Older participants were recruited through a database of volunteers who have offered to participate in research within the University of Otago's Department of Psychology and were reimbursed \$20 for their out-of-pocket and travel expenses. All participants spoke English, had normal or corrected-to-normal vision, and reported no neurological problems. Ethical approval was obtained from the Human Ethics Committee (Reference number = D15/403), and all participants gave informed consent prior to taking part in the study.

Stimuli and Measures

Basic emotion recognition task. The present study used 80 photographs of faces from the FACES database (Ebner et al., 2010), including equal numbers of young faces (age range = 19-31 years) and older faces (age range = 69-80 years). The photos consisted of 16 different models with age and gender balanced (i.e. four each of young male faces, young female faces, older male faces, and older female faces), each displaying five basic emotions (disgust, fear, anger, happiness, and sadness). All faces were forward-gazing, and photographs were displayed in full colour. Each image was 14.5cm (height) x 11cm (width), and when viewed from 60cm away, subtended a visual angle of 10.3° horizontally

and 13.5° vertically. Two examples are shown in Figure 1.



Figure 1. Examples of trials presented in the basic emotion recognition task: a) disgusted expression portrayed by a young face, b) angry expression portrayed by an older face.

Reading the Mind in the Eyes Test. Thirty-seven black-and-white photographs of eyes (from 18 male and 19 female faces) were used in the Reading the Mind in the Eyes Test (Baron-Cohen et al., 2001). Each image was 7.4cm (height) by 17.3cm (width), and exhibited a complex state of mind, such as 'worried', 'pensive', and 'despondent'. When viewed at a distance of 60cm, the stimuli subtended a visual angle of 16.1° horizontally and 7.0° vertically. An example is shown in Figure 2.

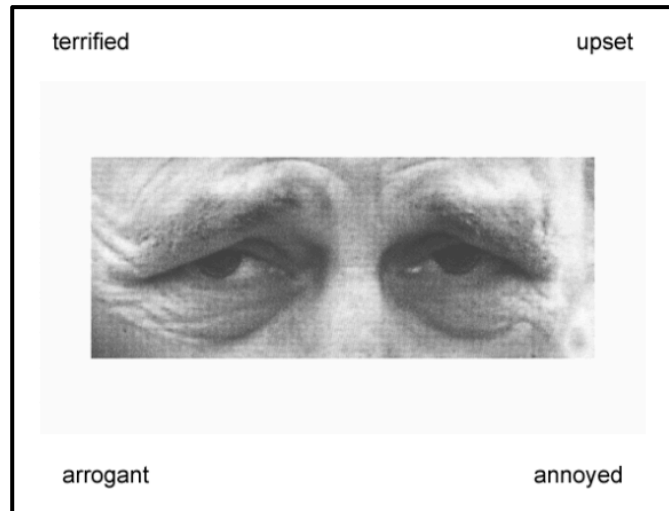


Figure 2. An example trial from the RMET, depicting eyes with an upset expression.

Six-item short form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI-6). Both young and older participants' level of state anxiety was measured prior to the emotion recognition tasks using the STAI-6, a brief questionnaire used to measure an individual's current degree of anxiety (Marteau & Bekker, 1992). The STAI-6 includes anxiety-present items such as, "I am worried", and anxiety-absent items such as, "I feel calm", which participants rated on a 4-point scale ranging from 1 (not at all) to 4 (very much). The anxiety-absent items were reverse-scored, and then all responses were summed to give a score between 6 and 24, with higher scores suggesting a greater level of state anxiety. The STAI-6 has been shown to have good reliability ($\alpha = .79 - .81$) and validity, with correlations between the STAI-6 and the 20-item state scale of the STAI ranging from .94 to .95 (Tluczek, Henriques, & Brown, 2009).

The Depression Anxiety Stress Scales-21 (DASS-21). Because mood can influence performance on emotion recognition tasks (e.g., Surguladze et al., 2004), depression, anxiety, and stress were screened for using the DASS-21, the short-form of Lovibond and Lovibond's (1995) 42-item self-report questionnaire designed to assess

depression, anxiety, and stress in adults. Scores on the DASS-21 are doubled to achieve equivalent scores to the DASS-42. The DASS-21 has been demonstrated to have high reliabilities and acceptable validity (Henry & Crawford, 2005).

The Mini-Mental State Examination (MMSE). To screen for dementia or mild cognitive impairment, older adults' cognitive ability was assessed using the MMSE (Folstein, Folstein, & McHugh, 1975). The MMSE has been shown to have good reliability and validity (Folstein et al., 1975), particularly for screening out dementia in non-clinical settings (Mitchell, 2009).

Procedure

At the outset, participants were screened with a Snellen eye test to ensure normal or corrected-to-normal vision. Subsequently, they were provided with information about the study, which differed according to the condition to which they were randomly assigned ('older threat', 'young threat', or control). The experimenter read information sheets to participants that included statements based on the stereotype threat manipulations from Abrams et al. (2006) and Swift et al. (2013). The stereotype threat statements provided to participants in each condition are detailed in Table 2 (and information sheets are presented in full in Appendix A).

Table 2.

Study Information Provided to Participants, Depending on Stereotype Threat Condition.

Condition	Stereotype Threat Statement
Older Threat	It is widely believed that the ability to recognise emotions declines with age. Therefore, the purpose of this study is to see whether older people do perform more poorly on emotion recognition tasks than young people. Both older and younger people will be taking part in this research.
Young Threat	It is widely believed that the ability to recognise emotions increases with age. Therefore, the purpose of this study is to see whether older people do perform better on emotion recognition tasks than young people. Both older and younger people will be taking part in this research.
Control	The purpose of this study is to examine how we respond to emotional information in faces. Different types of people will be taking part in this research.

Following the acquisition of written consent (see consent form in Appendix B), all participants completed the STAI-6 on paper. They then began the basic emotion recognition task, which was presented on a 22-inch monitor using E-Prime 2.0 software (Schneider, Eschman, & Zuccolotto, 2002). As depicted in Figure 1, each trial involved the presentation of a face stimulus in the centre of the screen, with five emotion labels displayed below the face in two rows (disgust, anger, sadness, fear, happiness), always in the same arrangement. Participants were required to indicate aloud which emotion label they believed matched the emotion exhibited by the face. The experimenter entered the response using assigned keys on the computer keyboard for each of the five emotions. Response times were not recorded. The next trial began after the experimenter entered the response. The order in which the 80 faces appeared was randomised.

Subsequent to completion of the emotion recognition task, participants completed the Reading the Mind in the Eyes task, also presented using E-Prime 2.0 (Schneider et al., 2002). Participants were first given a practice trial, followed by 36 experimental trials, an example of which can be seen in Figure 2. Each trial involved the participant choosing one of the four mental state labels (e.g. ‘terrified’, ‘upset’, ‘arrogant’, and ‘annoyed’) that they believed best matched the mental state of the person whose eyes were displayed in the photograph. Participants stated their choice aloud and the experimenter recorded their response using the assigned key for each of the mental states on the keyboard. As in the emotion recognition task, response times were not recorded.

To ensure that participants were paying attention when the manipulation was employed at the beginning of the study (i.e. when stereotypes were elicited or not elicited), a manipulation check was used. Participants were asked to circle one of three options that they believed to be the objective of the study: “To investigate whether older adults are *worse* than young adults at recognising emotions”, “to investigate whether older adults are *better* than young adults at recognising emotions”, or “to further our understanding of different people’s emotion recognition abilities (no mention of age-related differences)”.

Subsequently, to explore the extent to which young and older adults were worried about confirming negative stereotypes, participants were asked two questions adapted from Gaillard et al. (2011): “Were you worried that your ability to perform well on these tasks was affected by your age?” and “Were you worried that if you performed poorly on the test, the researcher would attribute your poor performance to your age?” Participants responded to these questions using a 7-point scale from 1 (not at all) to 7 (very much). Next, all participants answered three demographic questions about their age, gender, and highest level of education, before completing the DASS-21. Older adults were then

administered the MMSE. The full procedure typically took up to 30 minutes for the young adults, and up to 45 minutes for the older adults.

Results

Exclusion Criteria

Young and older adults were screened according to their age so that participants' age ranges fell between 18 – 30 years for young adults and 65 – 90 years for older adults. Further, all older adults scored above the cut-off on the MMSE (< 24), indicating no cognitive decline. However, six participants' data (two young adults, four older adults) were excluded for exceeding the cut-off score for severe depression, anxiety, and/or stress on the DASS-21. Data from 36 participants (12 young adults, 24 older adults) were also excluded for responding incorrectly to the manipulation check¹, and data from three older adults were excluded for problems with vision, as measured by the Snellen eye chart. A further older adult's data were excluded due to his adoption of an inappropriate strategy for selecting mental state labels on the RMET². Finally, another older adults' data were excluded due to his disclosure that, prior to participating in the experiment, he had researched emotion recognition in aging populations (thus invalidating the manipulation procedure). After exclusion criteria were applied, the remaining participants were 72 young adults (38 male) aged 18-29 ($M = 20.61$ years, $SD = 2.26$ years) and 83 older adults (42 male) aged 65-90 ($M = 72.43$ years, $SD = 4.98$ years).

¹ Although the number of older adults excluded from the study ($n = 24$) was double that of the number of young adults ($n = 12$), analyses conducted with the inclusion of these participants did not notably alter the primary research findings.

² This was based on the experimenter's judgement that the older male simply chose the first mental state label he attended to on the RMET (i.e. he responded immediately as the next set of words appeared, leaving no time to have actually read and considered all four words).

Preliminary Analyses

Participants' mean scores on the screening questionnaires (i.e. the DASS-21 scales and the MMSE) are depicted in Table 3, along with older adults' level of education. Independent samples *t*-tests indicated that older females and males did not differ with regard to their average education level, $t(81) = .54, p = .59$, nor average MMSE scores, $t(81) = .59, p = .56$. A multivariate analyses of variance (MANOVA) was conducted to investigate whether young and older males and females differed on the DASS-21 scales. On the depression scale, there were no significant differences between age or gender groups (all $ps > .05$). On the anxiety scale, there was a significant main effect of age, with young adults ($M = 5.00, SD = 4.18$) scoring higher than older adults ($M = 2.77, SD = 2.77$), $F(1, 151) = 15.32, p < .001, \eta_p^2 = .09$, but there were no effects of gender ($ps > .05$). Likewise, young adults' scores on the stress scale ($M = 10.25, SD = 6.67$) were higher than older adults' scores ($M = 8.12, SD = 5.16$), $F(1, 151) = 4.73, p = .03, \eta_p^2 = .03$, but gender did not have any significant effect ($ps > .05$). These results are somewhat consistent with research that susceptibility to anxiety, depression, and distress declines across the lifespan (Jorm, 2000). On all three scales (i.e., depression, anxiety, and stress), average scores for young and older age groups fell within the *normal* range (Lovibond & Lovibond, 1995).

Table 3.

Education Level and Screening Questionnaire Means (*SDs*) for Young and Older Adults in Study 1

	Young Adults		Older Adults	
	Female	Male	Female	Male
Education	–	–	5.07 (1.80)	4.90 (1.85)
DASS-21 Depression Scale	4.84 (4.69)	5.59 (4.20)	4.57 (4.72)	4.00 (2.76)
DASS-21 Anxiety Scale	5.16 (4.12)	4.82 (4.30)	2.90 (3.00)	2.71 (2.57)
DASS-21 Stress Scale	11.26 (6.62)	9.12 (6.65)	8.90 (6.01)	7.38 (4.01)
MMSE	–	–	28.38 (1.40)	28.24 (1.34)

Notes. Education level was categorised as 1 = primary school, 2 = some high school, 3 = high school, 4 = trade certificate, 5 = technical certificate, 6 = an undergraduate university degree, and 7 = postgraduate. This was only scored for older adults as all young participants were studying at University level.

The objective of recruiting equivalent numbers of male and female participants for the present study (counterbalanced across each age group) was to avoid any potential confounding effects of gender on the results. Because it was not of interest in relation to the primary hypotheses, gender has not been included as a variable in any of the reported data analyses. However, to check that gender did not change the significant effects revealed by primary analyses, the exact same analyses were conducted with the addition of gender as a between-subjects variable. These analyses confirmed that none of the significant effects found were affected by gender.

Furthermore, although initial analyses found that young adults scored slightly higher than older adults on the DASS-21 for anxiety and stress (as described above), including DASS-21 scores as covariates did not have an effect in any of the subsequent analyses. Given also that the DASS-21 was intended solely as a screening measure to exclude data from participants experiencing severe mental health problems, DASS-21 scores were not considered in further analyses.

The following data were analysed using analysis of variance (ANOVA), and all interactions were investigated further using *t*-tests. For all ANOVAs, Mauchly's Test of Sphericity was utilised to assess whether the assumption of sphericity was met. Where this assumption was violated, Huynh-Feldt corrected *F*, *p*, mean square error (*MSE*), and η_p^2 values are reported. Likewise, for all *t*-tests, Levene's Test for Equality of Variances was employed, and corrections subsequently made for any unequal variances. In the case of multiple comparisons, Bonferroni correction was applied to ensure the family-wise error rate was $p < .05$.

Threat-Based Concerns Across Conditions

Participants' responses on the 7-point scale for each of the two questions regarding explicit threat-based concerns were found to be significantly positively correlated, $r = .52$, $n = 155$, $p < .001$. Therefore, they were averaged to create a single score for each participant. These threat scores were then examined in a 2 (participant age group: young, older) x 3 (condition: control, older threat, young threat) between-subject analysis of variance (ANOVA). This analysis revealed a significant main effect of participant age group, $F(1, 149) = 19.17$, $p < .001$, $\eta_p^2 = .11$, with young adults reporting experiencing a greater degree of stereotype threat ($M = 2.18$, $SD = 1.08$) than older adults ($M = 1.52$, $SD = .86$). Further, there was a significant main effect of condition, $F(2, 149) = 5.62$, $p = .004$, $\eta_p^2 = .07$. A follow-up independent samples *t*-test showed that, compared to the control

condition ($M = 1.51$, $SD = .62$), participants were significantly more threatened in the young threat condition ($M = 2.07$, $SD = 1.18$), $t(77.3) = 3.03$, $p = .003$, and more threatened in the older threat condition ($M = 1.92$, $SD = 1.10$), $t(76.5) = 2.31$, $p = .02$ (non-significant according to a Bonferroni p value of .017). There was no significant difference between the latter two conditions, $t(100) = .65$, $p = .52$.

As shown in Figure 3, these main effects were qualified by a significant interaction of participant age group and condition, $F(2, 149) = 4.99$, $p = .008$, $\eta_p^2 = .06$. To explore this interaction further, one-way ANOVAs (comparing threat scores among the three conditions) were performed separately for young adults and older adults. Interestingly, there was no significant effect of stereotype threat condition on older adults' self-reported threat concerns, $F(2, 80) = 1.98$, $p = .15$, $\eta_p^2 = .05$. However, for young adults, there was a significant effect of condition, $F(2, 69) = 7.12$, $p = .002$, $\eta_p^2 = .17$.

Follow-up independent samples t -tests demonstrated that young adults reported feeling significantly more threatened in the young threat condition ($M = 2.77$, $SD = 1.07$) than in the control condition ($M = 1.71$, $SD = .66$), $t(46) = 4.14$, $p < .001$. Their self-reported threat concerns were also higher in the young threat condition compared to the older threat condition ($M = 2.06$, $SD = 1.17$), although this effect just failed to reach significance according to a Bonferroni-adjusted p value of .017, $t(46) = 2.18$, $p = .03$. There was no significant difference between control and older threat conditions, $t(46) = 1.29$, $p = .20$.

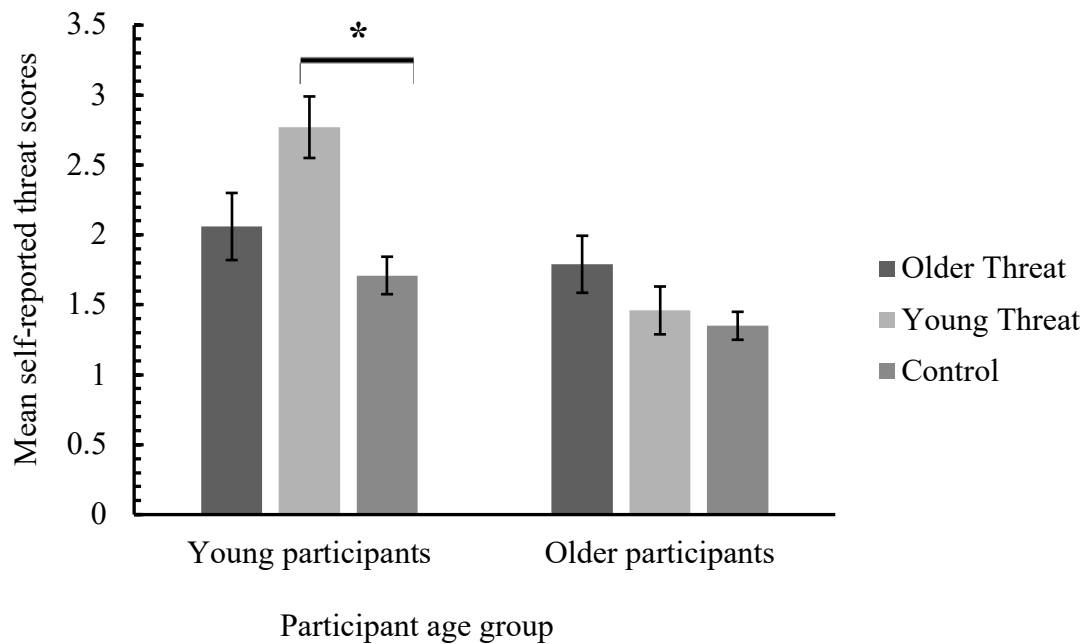


Figure 3. Mean self-reported threat scores as a function of participant age group and stereotype threat condition. Error bars denote one standard error around the mean and an asterisk denotes a significant difference between two mean scores.

From these results, it appears that the stereotype threat manipulation had the opposite effect to what was hypothesised in that it influenced overtly reported levels of stereotype threat for *young* adults, rather than older adults. Young adults reported feeling most threatened in the stereotype threat condition where it was implied that young adults are expected to perform worse than older adults at recognising emotions. Contrary to expectations, older adults' self-reported threat concerns did not differ between conditions.

State-Trait Anxiety Inventory-6 (STAI-6) Scores

Participants' scores on the six-item short form of the state scale of the Spielberger STAI were calculated. Scores ranged from 6 to 24, with higher scores indicating a greater degree of state anxiety. STAI-6 scores were analysed in a 2 (participant age group: young, older) x 3 (condition: older threat, young threat, control) between-subjects ANOVA. There

were no significant main effects; however, there was a significant interaction between participant age and condition, $F(2, 149) = 3.48, p = .03, \eta_p^2 = .05$, shown in Figure 4.

This interaction was explored further with one-way ANOVAs separately for young and older adults. For young adults, there was a significant main effect of condition, $F(2, 69) = 4.44, p = .02, \eta_p^2 = .11$. Follow-up *t*-tests demonstrated that young adults were significantly more anxious in the young threat condition ($M = 9.50, SD = 2.89$) than in the control condition ($M = 7.58, SD = 1.64$), $t(36.4) = 2.83, p = .008$. Young adults' state anxiety was also higher in the young threat condition compared to the older threat condition ($M = 8.75, SD = 2.03$), $t(46) = 2.19, p = .03$, although this difference was not significant according to a Bonferroni *p* value of .017.

For older adults, a one-way ANOVA indicated that there was no difference between their state anxiety scores between conditions, $F(2, 80) = .38, p = .69, \eta_p^2 = .01$. Thus, the stereotype threat manipulation did not lead older adults to report increased state anxiety. However, interestingly, young adults were more anxious in the condition in which it was implied that they were expected to perform worse than older adults.

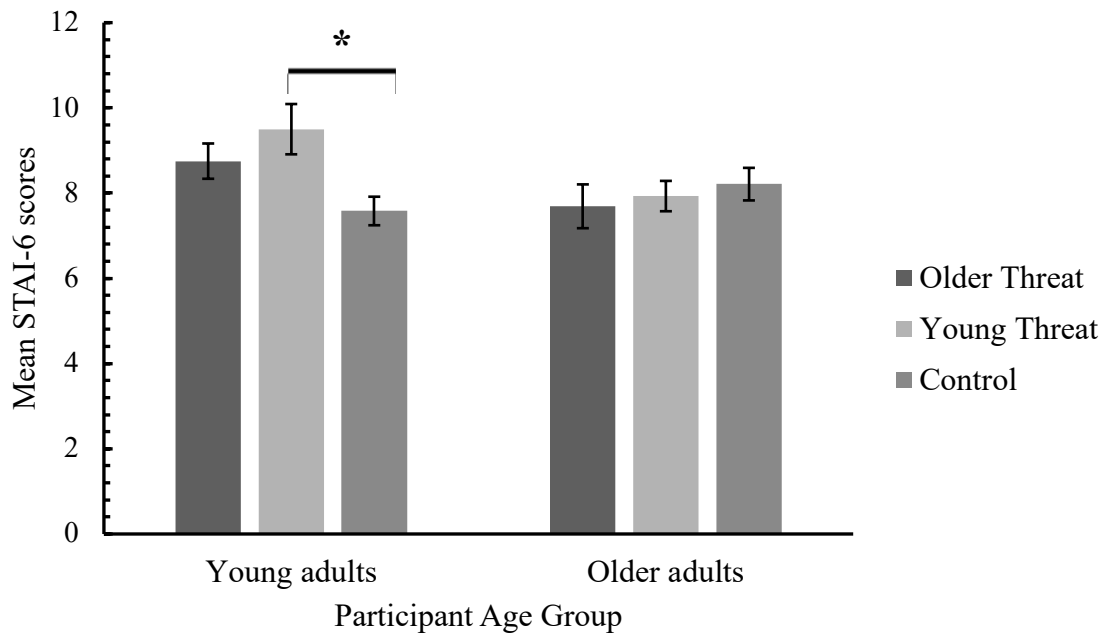


Figure 4. Young and older adults' mean STAI-6 scores in each experimental condition.

Error bars denote one standard error around the mean and an asterisk denotes a significant difference between two means.

Accuracy on the Basic Emotion Recognition Task

Initially, the mean proportion of accurately identified emotions was calculated for each participant, separately for each of the five emotions (disgust, fear, happiness, sadness, anger) and each face age (young, older). These mean proportion correct scores were then adjusted to ensure that there was no influence of emotion-specific response biases (see Isaacowitz et al., 2007). As an extreme example of an emotion-specific response bias, consider a hypothetical participant who selects 'happiness' as the label for every single emotion presented. They would obtain a perfect mean proportion correct score for the emotion 'happiness'. However, this result would be misleading as this participant was unable to correctly reject the times when the emotion displayed was *not* happiness.

Therefore, kappa scores were calculated using a formula³ that adjusted the mean proportion correct scores to account for any emotion-specific response biases. The resulting kappa scores ranged from 0 (performance at chance level) to 1 (all responses to the emotion were correct identifications and correct rejections). Young and older adults' kappa scores are depicted in Table 4 (for each combination of face age, participant age group, and emotion).

Emotion kappa scores were analysed in a 2 (participant age group: young, older) x 2 (face age: young, older) x 3 (condition: control, older threat, young threat) x 5 (emotion: disgust, fear, happiness, sadness, anger) mixed ANOVA. Older adults were shown to perform significantly worse overall ($M = .76, SD = .09$) than young adults ($M = .79, SD = .08$) on the basic emotion recognition task, $F(1, 149) = 6.06, p = .02, \eta_p^2 = .04$. A main effect of emotion was also found, $F(3.9, 583.3) = 162.86, p < .001, \eta_p^2 = .52$, such that happiness was most accurately recognised ($M = .95, SD = .06$), followed by fear ($M = .79, SD = .14$), disgust ($M = .72, SD = .14$), sadness ($M = .72, SD = .14$), and lastly, anger ($M = .68, SD = .14$).

These main effects were qualified by a significant interaction of emotion and participant age group, $F(3.9, 583.3) = 5.59, p < .001, \eta_p^2 = .04$, such that older adults performed worse than young adults on the basic emotion task for certain emotions, but performed equally well on others. Using independent samples *t*-tests, it was demonstrated that older adults were less accurate than young adults when recognising fear ($M = .76, SD = .13$ vs $M = .83, SD = .13$, respectively), $t(153) = 3.47, p = .001$, anger ($M = .65, SD = .15$ vs $M = .72, SD = .11$), $t(153) = 2.97, p = .003$, and happiness ($M = .93, SD = .07$ vs $M =$

³ $K = (\text{total number of correct responses and correct rejections} - \text{total number of responses expected by chance}) / (\text{total number of stimuli} - \text{number of responses expected by chance})$.

.97, $SD = .04$), $t(132.4) = 3.80$, $p < .001$. Older and young adults performed equally well when recognising disgust and sadness (all $ps > .05$).

The ANOVA also revealed a main effect of face age, $F(1, 149) = 261.25$, $p < .001$, $\eta_p^2 = .64$, with participants exhibiting better accuracy when emotions were expressed by young faces ($M = .83$, $SD = .09$) compared to when emotions were expressed by older faces ($M = .71$, $SD = .10$). This effect was qualified by a significant interaction of face age and emotion, $F(3.7, 549.7) = 20.48$, $p < .001$, $\eta_p^2 = .12$. Paired-samples t -tests revealed that, for all five emotions, accuracy was higher when the emotion was expressed by young faces compared to older faces. The difference in emotion recognition accuracy between young and older faces was largest for anger ($M = .79$, $SD = .16$ vs $M = .58$, $SD = .17$), $t(154) = 14.03$, $p < .001$, followed by sadness ($M = .78$, $SD = .16$ vs $M = .65$, $SD = .18$), $t(154) = 9.76$, $p < .001$, fear ($M = .85$, $SD = .14$ vs $M = .73$, $SD = .18$), $t(154) = 9.62$, disgust ($M = .76$, $SD = .15$ vs $M = .67$, $SD = .19$), $t(154) = 5.71$, $p < .001$, and lastly, happiness ($M = .98$, $SD = .04$ vs $M = .92$, $SD = .08$), $t(154) = 10.78$, $p < .001$.

As depicted in Table 4, the main effects and two-way interactions were further qualified by a significant three-way interaction of emotion, age of face, and participant age group, $F(3.7, 549.7) = 4.41$, $p = .002$, $\eta_p^2 = .03$. To investigate this interaction further, a 2 (participant age group: young, older) x 5 (emotion: disgust, fear, happiness, sadness, anger) mixed ANOVA was conducted once for young faces, and again for older faces.

When recognising emotions in young faces, there was a significant main effect of participant age group, whereby older adults were less accurate than young adults, $F(1, 149) = 6.23$, $p = .01$, $\eta_p^2 = .04$, qualified by a two-way interaction between emotion and participant age group, $F(4, 596) = 4.42$, $p = .002$, $\eta_p^2 = .03$. Follow-up independent t -tests were conducted to compare young and older adults' accuracy when recognising each individual emotion expressed by young faces. The t -tests revealed that older adults were

less accurate than young adults when labelling young faces displaying fear ($M = .82$, $SD = .13$ vs $M = .88$, $SD = .15$, respectively), $t(153) = 2.60$, $p = .01$, and anger ($M = .74$, $SD = .18$ vs $M = .84$, $SD = .12$), $t(144.1) = 3.97$, $p < .001$. Both age groups performed equally well when labelling disgust, happiness, and sadness expressed by young faces (all $ps > .05$).

Likewise, there was an interaction between emotion and participant age group for the recognition of emotions expressed by older faces, $F(3.7, 543.9) = 5.65$, $p < .001$, $\eta_p^2 = .04$. Independent t -tests demonstrated that older adults' emotion recognition accuracy scores were significantly lower than young adults' scores for older faces displaying fear ($M = .69$, $SD = .18$ vs $M = .78$, $SD = .16$, respectively), $t(153) = 3.36$, $p = .001$, and happiness ($M = .89$, $SD = .09$ vs $M = .94$, $SD = .06$), $t(142.1) = 3.96$, $p < .001$. There was no difference in accuracy between young and older adults when recognising disgust, anger, and sadness in older faces (all $ps > .05$).

Table 4.

Mean Emotion Recognition Accuracy Scores (Kappa) and Associated Standard Deviations for Each Combination of Face Age, Participant Age Group, and Emotion.

Age of face stimuli	Participant age group	Emotion				
		Disgust	Fear	Anger	Happy	Sad
Young faces	Young adults	0.77 (.15)	0.88^a (.15)	0.84^b (.12)	0.99 (.03)	0.79 (.15)
	Older adults	0.76 (.14)	0.82^a (.13)	0.74^b (.18)	0.98 (.05)	0.78 (.17)
Older faces	Young adults	0.64 (.20)	0.78^c (.16)	0.60 (.16)	0.94^d (.06)	0.66 (.17)
	Older adults	0.70 (.19)	0.69^c (.18)	0.56 (.18)	0.89^d (.09)	0.63 (.19)

Notes. Significant differences between young and older adults are identified in bold (accuracy scores with matching letters are significantly different from each other).

Critically for the present research question, stereotype threat condition did not affect participants' emotion recognition scores ($p > .05$), and there was no interaction effect between participant age group and condition ($p > .05$). In fact, there were no interaction effects involving stereotype threat condition (all $ps > .05$; see Table 5 for all ANOVA effects involving condition). This indicates that, although young adults reported feeling more threatened and more anxious when it was implied that their age group are worse at emotion recognition, such threat and anxiety was not detrimental to their actual performance on the task.

Table 5.

ANOVA Results for All Main and Interaction Effects on Emotion Recognition Accuracy Scores (Kappa) Involving Stereotype Threat Condition

Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η_p^2
Condition	2	.05	.61	.54	.01
ParticipantAge*Condition	2	<.001	.00	1.00	.00
Emotion*Condition	7.8	.01	.49	.86	.01
Emotion*ParticipantAge*Condition	7.8	.03	1.46	.17	.02
FaceAge*Condition	2	.02	1.00	.37	.01
FaceAge*ParticipantAge*Condition	2	.01	.22	.81	.00
Emotion*FaceAge*Condition	7.4	.01	.61	.76	.01
Emotion*FaceAge*ParticipantAge*Condition	7.4	.00	.36	.93	.01

Accuracy on the Reading the Mind in the Eyes Task (RMET)

For each participant, the mean proportion of eyes assigned with the correct mental state in the RMET was calculated. These accuracy scores were examined in a 2 (participant age group: young, older) x 3 (condition: control, older threat, young threat) between-subject ANOVA. The analysis revealed that young adults' accuracy ($M = .73$, $SD = .10$) did not significantly differ in comparison to older adults ($M = .72$, $SD = .10$) when recognising mental states on the RMET, $F(1, 149) = 1.00$, $p = .32$, $\eta_p^2 = .01$. There was also no significant main effect of condition, $F(2, 149) = .17$, $p = .85$, $\eta_p^2 = .00$, and no significant interaction of participant age group and condition, $F(2, 149) = .23$, $p = .79$, $\eta_p^2 = .00$.

Discussion

The results of the first study indicated that the stereotype threat manipulation had an effect, but not in the way that was expected. The main findings were that: 1) older

adults performed worse than young adults at recognising certain facially-expressed emotions (but performed equally on the RMET); 2) the stereotype threat condition was effective in increasing self-reported stereotype threat and state anxiety for young adults, but not older adults; and 3) young and older adults' performance on the basic emotion recognition task was unaffected by stereotype threat condition. Each of these findings are discussed in further detail below.

Firstly, the results demonstrated that, on the basic emotion recognition task, older adults were less accurate than young adults at recognising fear in young and older faces, anger in young faces, and happiness in older faces. This is consistent with previous research showing that older adults are poorer than young adults at recognising certain emotions (e.g., Ruffman et al., 2008). It also supports the idea that, even when the possibility of an own-age bias is controlled for by including young and older face stimuli, older adults still experience reduced emotion recognition ability compared to their younger counterparts (Campbell et al., 2017; Riediger, Voelkle, Ebner, & Lindenberger, 2011).

On the RMET, however, older adults were as accurate as young adults at assigning labels to complex mental states portrayed by sets of eyes. Although Henry and colleagues' (2013) meta-analysis demonstrated an overall age-related decline in theory of mind, the present study's finding is not completely surprising given that some previous studies have demonstrated that young and older adults perform equally on theory of mind tasks (e.g., Bottiroli, Cavallini, Ceccato, Vecchi, & Lecce, 2016; Castelli et al., 2010; Slessor, Phillips, & Bull, 2007), especially when older adults are motivated to do well (Zhang, Fung, Stanley, Isaacowitz, & Ho, 2013). In any case, the present study's results are consistent with a large body of research that negates an early suggestion that theory of mind might actually increase with age (Happé et al., 1998).

With regards the primary research question, it was hypothesised that eliciting stereotypes about age-related declines in emotion recognition would lead older adults to experience stereotype threat (and possibly increased state anxiety), and subsequently lead them to perform worse when recognising facially expressed emotions. This was not supported by the present study's results, which demonstrated that the threat manipulation did not lead to an increase in older adults' self-report of stereotype threat nor state anxiety, and did not alter their performance on the basic emotion recognition task. This is inconsistent with previous empirical research showing that eliciting age-related stereotypes about declines in cognition or memory negatively impacted older adults' performance on cognitive tasks (Lamont et al., 2015).

The second hypothesis was that, because young adults do not belong to the stigmatized group targeted by stereotypes about age-related cognitive decline, and are superior at recognising emotions, they would not feel threatened by being told that they are expected to be worse at recognising emotions. Consequently, it was expected that their emotion recognition ability would be unaffected. However, the results from the present study indicated that young adults *did* report heightened levels of stereotype threat when it was implied that their age group should perform worse. In fact, young adults also reported higher levels of state anxiety in this condition. Nevertheless, young adults' reports of higher stereotype threat and increased anxiety did not result in reduced performance on the basic emotion recognition task. This finding is consistent with a previous finding that younger adults reported experiencing greater stereotype threat than older adults in the workplace, but that this threat did not lead to detrimental consequences (such as low job satisfaction and poor employment-related mental health), perhaps due to young adults appraising it as somewhat of a challenge (von Hippel, Kalokerinos, & Henry, 2013).

The current study's findings raise the question of why young adults were threatened by the implication that they should be worse than older adults on a task domain (i.e., emotion recognition) that is scientifically known to decline with age. Furthermore, why were older adults *not* threatened? There are a few possible answers to these questions. Firstly, it was assumed that lay people view emotion recognition as a cognitive task and, therefore, that older adults would feel threatened due to societal stereotypes about older people being less cognitively adept. It is possible, however, that lay people do not automatically associate the recognition of emotions with cognitive ability (as they might with mathematics, memory, or mental rotation, for example). To scientists and researchers, the recognition of emotion is a complex task that involves multiple cognitive processes, including attention, perception, recognition (e.g., from memory, life experiences, and/or innate ability), and categorisation (Adolphs, 2002). However, to lay individuals, it is possible that the recognition of emotions is simply perceived as a basic social task. Whereas research has shown that people generally expect older individuals to perform poorly on cognitive tasks (Prohaska et al., 1984; Singer, 1986; Swift et al., 2013), people expect older adults to do well in certain social domains, such as being able to settle arguments, being polite, and understanding other people's points of view (Swift et al., 2013). Therefore, if it were indeed the case that people do not consider emotion recognition to be a cognitive task, it is entirely possible that people also do not believe that emotion recognition declines with age.

Thus, a second possible explanation for the lack of stereotype threat in older adults in the current study is that lay people might actually believe that emotion recognition ability *increases* with age. If this is true, then implying that young adults are worse than older adults at recognising emotions could actually lead young adults to feel threatened, as they would theoretically be the target of such a stereotype. Given that young adults in the

present study reported feeling threatened and anxious as a result of the stereotype threat manipulation, whereas older adults did not, this explanation is quite feasible. The possibilities that a) emotion recognition might be perceived more as a social task than a cognitive task and/or b) might be expected to increase with age were the subject of further exploration in the second study.

CHAPTER THREE

Study Two: Prevalent Aging Stereotypes Held by Young, Middle-Older and Older Adults

The main findings of Study 1 were that, contrary to expectations, raising stereotypes about age-related declines in emotion recognition did not lead older adults to experience increased threat concerns nor state anxiety, and did not affect their performance on an emotion recognition task. Conversely, young adults' self-reported threat concerns and state anxiety were significantly increased in the condition in which it was implied that they were expected to perform worse than older adults (although their emotion recognition performance was still unaffected). The latter finding is surprising given that young adults have actually been shown to be superior at recognising emotions (Ruffman et al., 2008) and are not the target of stereotypes about age-related cognitive decline. The current study aimed to interpret these findings through further exploration of current stereotypes about aging (particularly in relation to emotion recognition).

The hypotheses of Study 1 were largely based on the assumption that lay people perceive the recognition of emotion in faces to be a cognitive ability. Although emotion recognition is a cognitive task that relies heavily on visual perception, recognition, and decision-making (Adolphs, 2002), it also falls within the social domain. It is possible that lay people view emotion recognition less as a cognitive task and more as a social task, on which older adults may be expected to do well (Swift et al., 2013). If this is the case, then it follows that older adults might be expected to perform as accurately (or even more

accurately) than young adults when recognising emotions. To my knowledge, although one study has investigated beliefs about the *expression* of emotions across the lifespan (Montepare & Dobish, 2013), there has not yet been any research investigating lay people's perceptions of age differences in emotion recognition ability specifically.

Another assumption of the first study that requires confirmation was that there is indeed a societal stereotype that cognitive functioning declines across the lifespan. Previous research has indicated that people do believe older adults to be inferior on cognitive tasks (Prohaska et al., 1984; Singer, 1986; Swift et al., 2013), therefore, it is likely that the decline of cognition with age remains a currently pervasive stereotype. To confirm this, the present study also aimed to corroborate the generally accepted view that stereotypes regarding age-related declines in cognitive functioning are prevalent.

The primary objective of the second study was to clarify whether emotion recognition is viewed as a cognitive or a social task, and what stereotypes about aging are actually currently prevalent in a western society (United States of America; USA). Although there are undoubtedly cultural differences between people living in the USA and people in New Zealand (who comprised the participant sample in Study 1), research has shown that stereotypes about aging are relatively consistent across cultures (especially among western cultures; Löckenhoff et al., 2009). To address the first objective of Study 2, answers to the following questions were sought: 1) Do people primarily view emotion recognition as a cognitive or a social task? 2) Are there any stereotypes about changes in social ability across the lifespan? 3) Do lay people believe that emotion recognition declines with age? 4) Is there indeed a stereotype that cognitive ability declines with age?

Researchers have emphasised the importance of collecting data about stereotypes from participants of varying age groups, as aging stereotypes have been found to differ across ages (Davis & Friedrich, 2010; Hummert, Gartska, Shaner, & Strahm, 1994).

Therefore, individuals from three different age groups were recruited to participate in the current study. Young adults (aged 18-30) and older adults (aged 65 and over) were included in order to compare the perceptions about aging between those who belong to the stigmatised age group and those who do not. A third participant age group (aged 50-64 years – classified in the current study as “middle-older” adults) was included in the current study to obtain an idea of the current aging stereotypes held by individuals who may not yet feel as though they belong to the stigmatised age group but are soon approaching it.

To explore the stereotypes related to aging, participants were asked to consider whether they believed a typical 25-year-old adult or a typical 75-year-old adult would be more competent in a number of different task domains (such as, memory, emotion recognition, cognitive tasks, and social ability) or whether they believed there to be no difference in competency between these ages. Participants were also asked a forced-choice question about whether they perceive the recognition of emotion to be predominantly a cognitive or a social task.

A second objective of the present study was to investigate whether older adults’ perceptions of aging are related to their ability to recognise emotions. Compared to other common stereotypes (e.g., relating to race or gender), age-related stereotypes are unique in that most people will eventually belong to the stigmatized group (Cuddy & Fiske, 2002). Therefore, stereotypes that a young person might hold about older adults ultimately become self-stereotypes, or beliefs about the positive and negative effects of one’s own ageing (Levy, 2003; Robertson et al., 2016). In a similar manner to experimentally-induced stereotype threat, the self-stereotypes that an older person holds may negatively affect their abilities in a number of relevant areas, such as memory, physical activity, and cognition.

Indeed, a longitudinal study by Robertson and colleagues (2016) demonstrated that, for older adults aged 50-93 years, more negative self-perceptions of aging – as measured by the Brief-Aging Perceptions Questionnaire (BAPQ; Sexton, King-Kallimanis, Morgan, & McGee, 2014) – were associated with greater declines in verbal fluency and self-rated memory over two years. Another study showed that older adults (aged over 60 years) with positive perceptions of aging were less likely to develop dementia, even if they were carriers of the high-risk *APOE* ϵ 4 gene (which greatly increases one's likelihood of developing dementia; Levy, Slade, Pietrzak, & Ferrucci, 2018).

Taking into account this previous research, the present study aimed to explore young, middle-older, and older adults' self-perceptions of aging and how these perceptions might be related to emotion recognition ability. Participants' perceptions of aging were measured using the B-APQ (Sexton et al., 2014), which is designed to assess agreement with various positive and negative views of aging (such as, "As I get older I get wiser" and "Getting older makes me less independent").

Participants' emotion recognition ability was tested using the Geneva Emotion Recognition Test (Short Version; GERT-S), a dynamic, multi-modal task comprising video clips of actors expressing 14 different emotions (Schlegel & Scherer, 2016). It has been suggested that using multimodal (i.e., a combination of visual and auditory), dynamic portrayals of emotion may be more ecologically valid than requiring participants to recognise emotions from photographs of posed faces (Schlegel, Fontaine, & Scherer, 2017). Furthermore, Ruffman (2011) suggested that emotion recognition tasks that use dynamic videos may improve older adults' performance, and in some cases, have been shown to eradicate differences found between young and older adults' emotion recognition accuracy (Wieck & Kunzmann, 2017). However, the research evidence remains mixed, with other studies demonstrating age-related deficits in emotion recognition despite

utilising dynamic expressions of emotion (Ruffman, Sullivan, & Dittrich, 2009; Sullivan & Ruffman, 2004).

The GERT-S also includes a wider range of emotions than many other emotion recognition tasks. While many paradigms include the identification of a few negative emotions (e.g., anger, fear, sadness, and disgust), they often include only one positive emotion (happiness; Schlegel & Scherer, 2016). Thus, participants completing such emotion recognition tasks might select the label of happiness for any face that appears to have a positive valence, rather than actually recognising happiness (Frank & Stennett, 2001; Schlegel & Scherer, 2016). The GERT-S, on the other hand, includes 14 emotions, of which seven are negative (e.g., sadness, irritation, and anxiety) and seven are positive or neutral (e.g., amusement, pride, and joy).

To date, no studies have directly compared young and older adults' performance on the GERT-S, although Schlegel and Scherer (2016) found no correlation between age and GERT-S scores for participants aged 18 – 65 years. Interestingly, a negative correlation between age and emotion recognition scores was demonstrated when the original, longer version of the GERT was used (Schlegel et al., 2017). Nevertheless, neither of these studies included participants older than age 65, limiting the conclusions that can be drawn from them. Therefore, although outside of the main research focus, the current study may help to clarify whether there are differences between young, middle-older, and older adults in emotion recognition accuracy on the GERT-S.

With regard to the relationship between perceptions of aging and emotion recognition ability, it was hypothesised that, for older (and possibly middle-older) adults, more negative perceptions of aging on the B-APQ would be associated with lower performance on the GERT-S. This finding would be consistent with previous research

indicating that more negative perceptions are correlated with greater declines in cognitive functioning (Robertson et al., 2016).

To my knowledge, no studies have investigated young adults' B-APQ scores. Whereas older adults' perceptions of aging reflect their self-perceptions of their own aging process and outcomes (Robertson et al., 2016), young adults' perceptions of aging may not be as self-relevant. For instance, a young adult's endorsement of a B-APQ item (such as, "slowing down with age is not something I can control") demonstrates their belief about an aspect of aging; however, they would be unlikely to worry about experiencing such effects of aging until they join older adulthood. As such, it was considered unlikely that young adults' B-APQ scores would be related to their emotion recognition ability.

To summarise, the two primary objectives of the current study were to:

1. Determine what stereotypes about aging currently exist among young, middle-older, and older adults. Specifically, do lay people view emotion recognition as a cognitive or a social task? Further, what are their beliefs about young and older adults' competencies (particularly with regard to social tasks, emotion recognition, and cognitive tasks)?
2. Investigate the relationship between self-perceptions of aging and accuracy on a dynamic, multimodal emotion recognition task. Specifically, are more negative aging perceptions related to poorer emotion recognition performance in older adults?

Method

Participants

After exclusions were applied to the data (described in the results section), the participants included 123 young adults (55 male) aged 18-30 ($M = 25.2$ years, $SD = 3.17$ years), 154 middle-older adults (68 male) aged 50-64 ($M = 55.7$ years, $SD = 3.83$), and 143

older adults (61 male) aged 65-99 ($M = 69.0$ years, $SD = 4.45$ years) from the United States of America. Participants were recruited through Amazon Mechanical Turk, a crowdsourcing Internet marketplace that recruits ‘workers’ to complete tasks for compensation. For this 20-30 minute study, MTurk workers were remunerated \$0.90 to \$1.00⁴. All participants spoke English and reported no neurological difficulties. Ethical approval was obtained from the University of Otago Human Ethics Committee (Reference number = D17/006).

Stimuli and Measures

The Geneva Emotion Recognition Test – Short Version (GERT-S). The GERT-S (Schlegel & Scherer, 2016) is a 42-item emotion recognition task designed to assess people’s ability to recognise emotions in another person’s facial expression, tone of voice, and body language. On average, the GERT-S takes approximately ten minutes to complete. Each trial consists of a short video clip of an actor portraying an emotion, with nonsensical syllables used to express emotional tone of voice. The video clips used were from the Geneva Multimodal Emotion Portrayals database (GEMEP, Bänziger et al., 2011). Ten actors (five male, five female) conveyed 14 different emotions: pride, joy, amusement, pleasure, relief, interest, surprise, anxiety, fear, despair, sadness, disgust, irritation, and anger. Over the course of the test, each emotion was presented three times (resulting in a total of 42 trials). After each video clip, 14 emotion words were presented in a circular arrangement (shown in Figure 5) and participants were required to select the emotion label that they believed best described the emotion portrayed by the actor in the clip.

⁴ Remuneration was increased slightly partway through the study to better incentivise participation.

Please select the word that describes best the emotion that the actor tried to express in the previous video.



Figure 5. The circular response format of the GERT-S (Schlegel & Scherer, 2016). After each video clip, participants were required to select the emotion label that best matched the emotion expressed by the actor in the clip.

The Brief Ageing Perceptions Questionnaire (B-APQ). The B-APQ (Sexton et al., 2014) is a 17-item short version of the Ageing Perceptions Questionnaire (APQ; Barker, O’Hanlon, McGee, Hickey, & Conroy, 2007). The questionnaire assesses self-perceptions and beliefs about one’s own aging, and was used in the present study to assess the extent to which participants endorse negative stereotypes and perceptions of aging. Items in the B-APQ include, “I get depressed when I think about how aging might affect the things that I can do” and, “As I get older I can take part in fewer activities”. Responses to items are made on a scale from 1 (strongly disagree) to 5 (strongly agree). The B-APQ is comprised of five subscales. The ‘Timeline-Chronic’ subscale is used to measure the extent to which people view the aging process as chronic (higher scores indicate more negative perceptions). The ‘Consequences-Positive’ subscale measures beliefs about

positive consequences of aging (e.g., getting wiser), with higher scores representing more positive perceptions. The ‘Emotional Representations’ subscale assesses negative emotional responses to aging, such as anxiety, depression, and worry (higher scores indicate more negative perceptions). The ‘Consequences and Control Negative’ subscale measures beliefs about negative consequences of aging and feeling a lack of control over the aging process (higher scores indicate more negative perceptions). Finally, the ‘Control-Positive’ subscale measures beliefs about having control over some elements of aging, with higher scores reflecting more positive perceptions. The B-APQ has been found to be psychometrically valid and reliable (Sexton et al., 2014).

The Depression Anxiety Stress Scales-21 (DASS-21). To screen for depression, anxiety, and stress, the DASS-21 was employed. The DASS-21 is the short version of the 42-item self-report questionnaire (Lovibond & Lovibond, 1995), and has been demonstrated to have good reliability and acceptable validity in assessing depression, anxiety, and stress in adults (Henry & Crawford, 2005). If participants’ scores on any of these three constructs exceeded the cut-off scores for extremely severe depression, anxiety, or stress, their data were omitted from the study.

Procedure

After clicking on a link provided through MTurk, participants were presented with a survey using Qualtrics software (<https://www.qualtrics.com>). Participants initially answered demographic questions (see Appendix C) regarding their age in years, date of birth, gender, ethnicity, and level of education, in addition to screening questions about English proficiency, whether they were currently taking any medication, and whether they had suffered any neurological problems (such as dementia or brain damage). If a

participant did not meet the age requirements, the survey then ceased⁵. If a participant's age was within one of the target age brackets, they were permitted to continue on to the main survey. These participants were then provided with information about the study (see Appendix D) and were required to give written informed consent before proceeding (see consent form in Appendix E).

First, participants were asked a number of questions about their perceptions of young and older adults' competencies in various task domains (see Appendix F). The questions were based on Swift et al.'s (2013) study, in which they asked participants to choose who they believed would perform better in particular skill areas: adults aged 25, adults aged 75, or whether they perceive there to be no difference in ability between these age groups. These questions were adopted in the current study to obtain an overall understanding of the current prevalent age-related stereotypes in society, including whether people generally believe that older adults are worse or better than young adults on cognitive tasks, social tasks, and more specifically, recognising other people's emotions. The original items used in Swift et al.'s (2013) study were retained (e.g., solving a crossword, looking after children, and settling arguments), and additional items were added that relate directly to the current research question (e.g., completing cognitive tasks, social interaction, and recognising emotions in other people's faces).

After the participants completed these items, they were presented with the following forced choice question: "Do you think the recognition of emotions in other people's faces is predominantly a cognitive task? OR a social task?" Participants were required to select only one of these responses. The aim of this question was to investigate

⁵ If the survey ended here (due to not meeting age requirements), participants were not compensated. However, they were forewarned prior to clicking the MTurk link that there would first be an eligibility screen and that they would not be compensated if deemed ineligible.

whether people primarily perceive emotion recognition as a cognitive task (at which older adults might be expected to perform worse than young adults) or a social task (at which older adults might generally be expected to perform equally). Next, participants completed the B-APQ and the DASS-21, followed by the GERT-S. Finally, participants confirmed whether all of the videos and audio in the GERT-S worked properly (if not, their data were excluded from the study).

Results

Exclusion Criteria

10,880 MTurk workers clicked through to the present study's initial eligibility screen. 8.2% of these workers ($n = 896$) met the requirement for being aged within one of the three required age brackets and thus were permitted to continue on to the main survey. Participants' data were excluded from the current study if they: reported currently taking medication for depression or anxiety; had scores on the DASS-21 exceeding the cut-off for extremely severe depression, anxiety, and/or stress; reported current neurological problems; indicated that any of the GERT video clips did not work properly; or did not complete the survey. After the application of exclusion criteria, the remaining participants included 123 young adults (55 male) aged 18-30 ($M = 25.2$ years, $SD = 3.17$ years), 154 middle-older adults (68 male) aged 50-64 ($M = 55.7$ years, $SD = 3.83$), and 143 older adults (61 male) aged 65 and over ($M = 69.0$ years, $SD = 4.45$ years).

Preliminary Analyses

Participants' average scores on each of the DASS-21 scales are displayed in Table 6 for each age group and gender, along with their average level of highest education. To determine whether self-reported levels of depression, anxiety, and stress differed across age groups or genders, the three DASS-21 scales scores were analysed in a 3 (participant age group: young, middle-older, older) x 2 (gender: female, male) multivariate analysis of

variance (MANOVA). For each of the DASS-21 scales, there were main effects of both gender and participant age group (all p s < .05), but no interactions between the two variables. With regard to the main effect of gender, it was found that males scored higher than females on the depression scale ($M = 9.91$, $SD = 7.88$ vs $M = 6.47$, $SD = 7.07$), $F(1, 414) = 20.72$, $p < .001$, $\eta_p^2 = .05$, the anxiety scale ($M = 8.51$, $SD = 6.49$ vs $M = 4.75$, $SD = 5.57$), $F(1, 414) = 39.98$, $p < .001$, $\eta_p^2 = .09$, and the stress scale ($M = 11.51$, $SD = 8.47$ vs $M = 8.95$, $SD = 7.40$), $F(1, 414) = 9.79$, $p = .002$, $\eta_p^2 = .02$.

The main effects of participant age group on the depression scale, $F(2, 414) = 6.61$, $p = .001$, $\eta_p^2 = .03$, anxiety scale, $F(2, 414) = 10.51$, $p < .001$, $\eta_p^2 = .05$, and stress scale, $F(2, 414) = 14.72$, $p < .001$, $\eta_p^2 = .07$, were explored further using independent samples t -tests. These showed that young adults and middle-older adults' scores did not significantly differ on any of the DASS-21 scales (all p s > .05). However, on each scale, older adults had lower scores than both young and middle-older adults (all p s < .05). Nevertheless, including the three scales as covariates in subsequent analyses did not influence the significant main and interaction effects involving gender or participant age group. Consequently, DASS-21 scores were not included in further analyses.

Participants' highest level of education scores were analysed in a 3 (participant age group: young, middle-older, older) x 2 (gender: female, male) analysis of variance (ANOVA), which revealed only a main effect of age group, $F(2, 414) = 3.15$, $p = .04$, $\eta_p^2 = .02$. Follow-up t -tests demonstrated that older adults ($M = 5.34$, $SD = 1.60$) had a slightly (but significantly) higher level of education compared to young adults ($M = 4.92$), $SD = 1.54$), $t(264) = 2.19$, $p = .03$, but that there were no significant differences in education level between middle-older adults ($M = 5.04$, $SD = 1.59$) and the other two age groups (both p s > .05). This difference in education level between young and older adults likely

reflects the fact that many young participants reported being partway through completing a college degree.

Table 6.

Education Level and DASS-21 Scale Means (*SDs*) for Young, Middle-Older, and Older Males and Females in Study 2

	Young Adults		Middle-Older Adults		Older Adults	
	Female	Male	Female	Male	Female	Male
Education	5.16 (1.43)	4.62 (1.63)	4.98 (1.58)	5.12 (1.62)	5.21 (1.62)	5.52 (1.58)
DASS-21 Depression Scale	8.38 (7.74)	10.69 (7.13)	6.09 (7.12)	11.41 (8.31)	5.29 (6.13)	7.54 (7.59)
DASS-21 Anxiety Scale	6.26 (6.17)	9.60 (6.21)	4.67 (5.87)	9.82 (6.50)	3.59 (4.36)	6.07 (6.12)
DASS-21 Stress Scale	11.97 (8.38)	12.69 (7.51)	8.77 (6.88)	13.41 (8.81)	6.63 (6.16)	8.33 (8.13)

Notes. Education level was categorised as 1 = primary school, 2 = some high school, 3 = high school, 4 = trade certificate, 5 = technical certificate, 6 = an undergraduate university degree, and 7 = postgraduate.

As in the first study, gender was not included as a variable in the subsequent analyses (but there were approximately equivalent numbers of males and females within each participant age group), nor were DASS-21 scores. The following data were analysed using chi square tests of independence, chi square tests of goodness of fit, and ANOVAs. For analyses using the latter, Mauchly's Test of Sphericity was employed, and Huynh-Feldt corrected F , p , and η_p^2 values were reported where the assumption of sphericity was violated. All interaction effects found using ANOVAs were further investigated using post-hoc comparisons or t -tests, with corrections made for any unequal variances

according to Levene's Test for Equality of Variances. The Bonferroni correction was applied to multiple comparisons to ensure the family wise error rate was $p < .05$.

Age-Related Stereotypes Endorsed by Young, Middle-Older, and Older Participants

During the survey, participants were asked to choose whether they believed adults aged 25 or adults aged 75 were more competent on a number of varying tasks, or whether they believed there to be no difference in competency between these age groups. The percentage of participants who selected each response ("adults aged 25", "no difference", or "adults aged 75") was calculated for each competency domain (e.g. "solving crossword puzzles"), separately for each age group. These percentages, for each competency domain and each age group, are given in full in Table G-1 (in Appendix G). In all competency domains, and for each age group separately, chi-square tests for goodness of fit revealed significant differences between the percentage of participants who selected "Adults aged 25", "No difference", and "Adults aged 75" (all $ps < .05$). The results of these chi-square tests are also reported in Table G-1. The percentage data for the competency domains that are integral to the present study's research question are presented below, in Table 7.

Table 7.

Percentage of Participants Who Selected Either “Adults Aged 25”, “No Difference”, or “Adults Aged 75” as Most Competent in Relevant Domains, for Each Participant Age Group

Competency domain	Participant age group	Percentage of participants who selected “adults aged 25”, “no difference” or “adults aged 75”		
		Adults aged 25	No difference	Adults aged 75
Social Interaction	18-30	41.5	51.2	7.3
	50-64	30.5	54.5	14.9
	65+	18.2	67.1	14.7
	Mean (all ages)	29.5	57.9	12.6
Recognising emotions in others’ faces	18-30	10.6	56.1	33.3
	50-64	5.2	45.5	49.4
	65+	4.2	51.7	44.1
	Mean (all ages)	6.4	50.7	42.9
Understanding how someone is feeling/what they are thinking	18-30	17.1	59.3	23.6
	50-64	3.2	42.2	54.5
	65+	4.2	49.7	46.2
	Mean (all ages)	7.6	49.8	42.6
Completing cognitive tasks (e.g. involving attention, problem-solving, and decision-making)	18-30	69.1	28.5	2.4
	50-64	56.5	37.7	5.8
	65+	53.1	40.6	6.3
	Mean (all ages)	59.0	36.0	5.0
Understanding others’ emotional body language	18-30	11.4	68.3	20.3
	50-64	11.7	48.7	39.6
	65+	4.2	47.6	48.3
	Mean (all ages)	9.0	54.0	36.9

Completing memory tasks	18-30	84.6	13.0	2.4
	50-64	83.8	13.6	2.6
	65+	77.6	19.6	2.8
	Mean (all ages)	81.9	15.5	2.6
Recognising the emotion in others' tone of voice	18-30	9.8	69.1	21.1
	50-64	2.6	55.2	42.2
	65+	0	55.2	44.8
	Mean (all ages)	3.8	59.3	36.9

Notes. Percentages presented in bold are the highest within each participant age group (significance level of $p < .05$). Where the second-highest percentage is statistically equivalent to the highest, that percentage is also bolded.

As shown in Table G-1, participants endorsed many age-related stereotypes that are consistent with stereotypes established in previous studies (e.g., Swift et al., 2013). For example, participants from all three age groups judged 25-year-olds to be more competent than 75-year-olds at driving, learning new skills, using the internet, completing memory tasks, completing computer tasks, and completing a running race. Importantly for the present research's focus on age-related differences in cognition, a significantly higher percentage of participants from all three age groups judged 25-year-olds to be the most competent at completing cognitive tasks, compared to those who judged 75-year-olds to be most competent (presented in Figure 6).

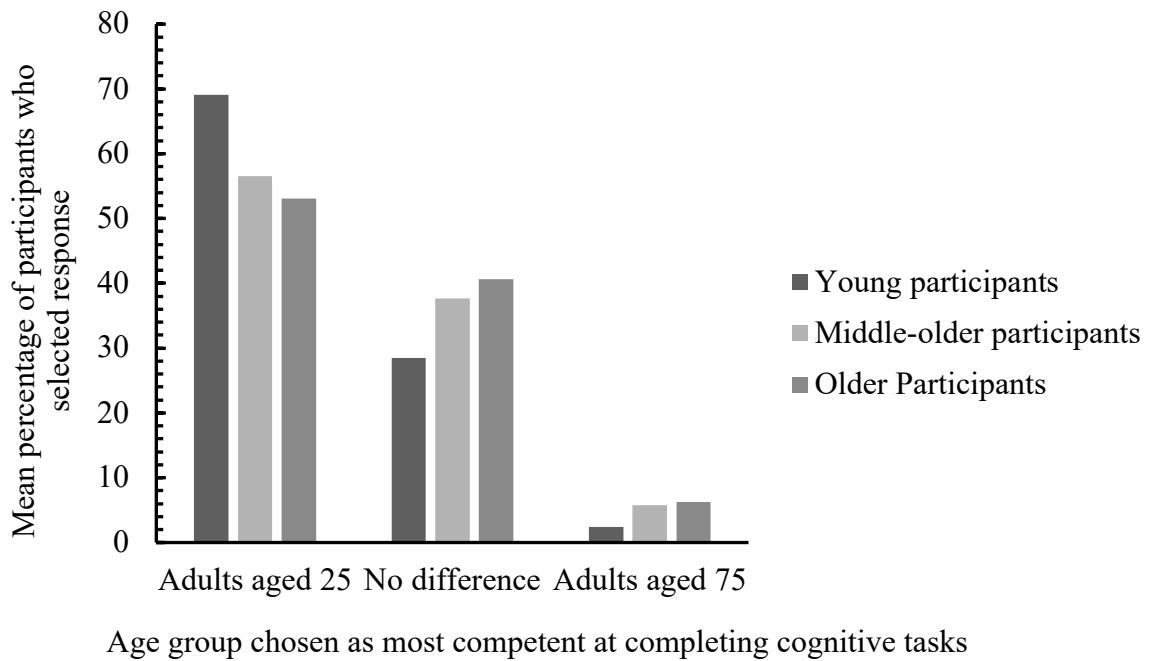


Figure 6. Mean percentage of participants who perceive the greatest competency on cognitive tasks to be among adults aged 25, adults aged 75, or that there is no difference.

In addition to the negative aging stereotypes, there were also some positive aging stereotypes endorsed. Participants from all three age groups judged 75-year old individuals to be more competent than 25-year old individuals at making financial decisions and imparting knowledge and wisdom, and better or equal to 25-year old people at reading for pleasure, being polite, settling arguments, understanding others' viewpoints, and managing staff. Interestingly, participants judged adults aged 75 to be either equal to or worse than adults aged 25 at solving crosswords, despite previous research demonstrating that older adults were expected to be more competent at this task (Swift et al., 2013). Regarding the domain of social interaction, a majority of young, middle-older, and older adults judged there to be no difference in competency between adults aged 25 and adults aged 75.

With regard to the specific research question relating to emotion recognition (and to a lesser extent, theory of mind), participants consistently judged a typical 75-year-old individual to be equal to, or more competent than, a typical 25-year-old. For example,

young participants were most likely to believe that, when recognising emotions in others' faces, there is no difference in competency between people aged 25 and people aged 75. Only 10.6% of young participants believed that people aged 25 would be more competent at recognising facially expressed emotions. For this task domain, both middle-older and older participants were equally likely to say that there is no difference between people aged 75 and people aged 25, or that people aged 75 years are actually *more* competent. These data are illustrated further in Figure 7.

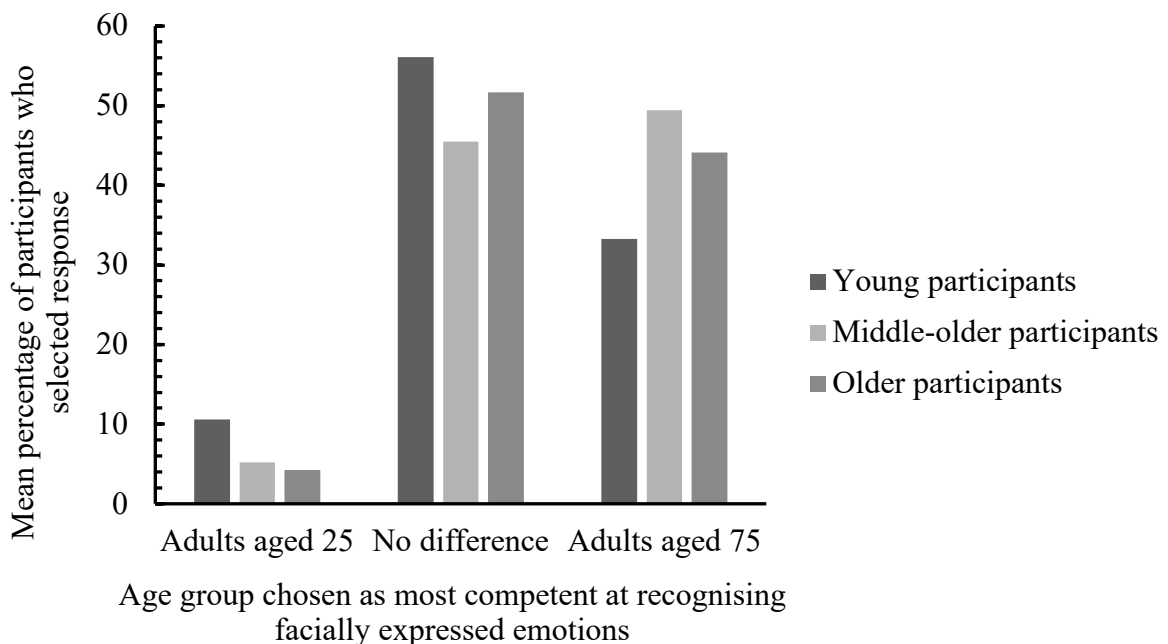


Figure 7. Mean percentage of participants who perceive the greatest ability to recognise facially expressed emotions to be among adults aged 25, adults aged 75, or that there is no difference.

Similar results were found for every other task domain related to emotion recognition or theory of mind. When considering an individual's ability to understand how someone is feeling or what they are thinking, young participants were most likely to say there is no difference in competency between adults aged 25 and adults aged 75, while

middle-older and older participants judged that adults aged 75 are as good as, or better than, adults aged 25. Likewise, the majority of young participants believed that adults aged 25 and adults aged 75 are equally competent at understanding others' emotional body language, while middle-older and older adults judged that adults aged 75 perform equally or better than adults aged 25 within this task domain. The same pattern of results was found for the task domain of recognising the emotion in others' tone of voice. Thus, it appears clear that, despite an abundance of research demonstrating that emotion recognition declines with age (Gonçalves et al., 2018; Ruffman et al., 2008), lay people believe older adults are equal to or better than young adults at recognising emotions.

Perceptions of emotion recognition as a cognitive or social task. The percentage of participants who consider the recognition of emotions to be either a cognitive task or a social task was calculated for each age group separately. A chi-square test of independence was then conducted to see whether participant age group was related to whether participants view the recognition of emotions as a social or a cognitive task. The relationship between these two variables was significant, $X^2(2, N = 420) = 8.01, p = .02$. To explore this effect further, individual chi-square tests of goodness of fit were conducted for each participant age group separately, to investigate whether more participants consider emotion recognition to be a cognitive task or a social task.

For young participants, the chi-square test for goodness of fit was significant, $X^2(1, N = 123) = 15.03, p < .001$, suggesting that participants in this age group consider the recognition of emotions to be more of a social task (67.5% of young adults) than a cognitive task (32.5%). For the middle-older participants, the chi-square test did not reach significance, $X^2(1, N = 154) = 3.14, p = .08$, indicating that the percentages of middle-older adults who consider the recognition of emotions to be a social task (57.1%) or a cognitive task (42.9%) did not significantly differ. Similarly, the chi-square test for

participants aged over 65 was insignificant, $X^2(1, N = 143) = .01, p = .93$, with equal percentages of participants considering emotion recognition to be a social task (50.3%) or a cognitive task (49.7%).

Young, Middle-Older, and Older Adults' Perceptions of Aging and Their Relationship with Emotion Recognition Ability

Subscale scores on the Brief Aging Perceptions Questionnaire were calculated for each participant by averaging their responses to items separately for each particular subscale. The resulting scores ranged from 1 (strongly disagree) to 5 (strongly agree). For the subscales 'Timeline-Chronic', 'Emotional Representations', and 'Consequences and Control Negative', higher scores represent more negative perceptions of aging, whereas for the subscales 'Consequences-Positive' and 'Control-Positive', higher scores represent more *positive* perceptions of aging.

A one-way MANOVA was utilised to compare BAPQ scores between participant age groups on each of the three negative subscales (see Figure 8) and both of the positive subscales (see Figure 9). The analysis revealed significant main effects of participant age group for the 'Timeline-Chronic' subscale, $F(2, 417) = 11.80, p < .001, \eta_p^2 = .05$, 'Emotional Representations' subscale, $F(2, 417) = 4.94, p = .008, \eta_p^2 = .02$, and the 'Consequences-Positive' subscale, $F(2, 417) = 4.05, p = .02, \eta_p^2 = .02$. Participant age groups did not significantly differ in their scores on the 'Consequences and Control Negative' subscale, $F(2, 417) = 2.17, p = .12, \eta_p^2 = .01$, nor on the 'Control-Positive' subscale, $F(2, 417) = .67, p = .51, \eta_p^2 = .00$.

To explore the significant main effects of participant age group on these mean subscale scores, post-hoc comparisons were conducted to compare the scores of the three age groups. On the 'Timeline-Chronic' subscale, young participants had significantly lower scores ($M = 2.64, SD = .69$) than middle-older participants ($M = 2.99, SD = .71$), $p <$

.001, and older participants ($M = 3.06, SD = .81$), $p < .001$, indicating that young participants have less negative perceptions about the chronicity of aging. There was no significant difference between scores of middle-older and older participants, $p = 1.00$.

On the 'Emotional Representations' subscale, young participants' scores ($M = 2.69, SD = .92$) were significantly higher than middle-older participants ($M = 2.44, SD = .85$), $p = .04$, and older participants ($M = 2.38, SD = .81$), $p = .009$, which is suggestive of more negative emotional responses to aging (such as depression, anxiety, and worry). Middle-older and older participants did not differ on this subscale, $p = 1.00$. Finally, on the 'Consequences- Positive' subscale, older participants had significantly lower scores ($M = 4.00, SD = .71$) than middle-older adults ($M = 4.21, SD = .61$), $p = .02$, suggesting less positive perceptions about the consequences of aging. However, the scores of older participants did not significantly differ from those of young participants ($M = 4.09, SD = .61$), $p = .79$, nor did middle-older participants' scores differ from young participants' scores, $p = .35$.

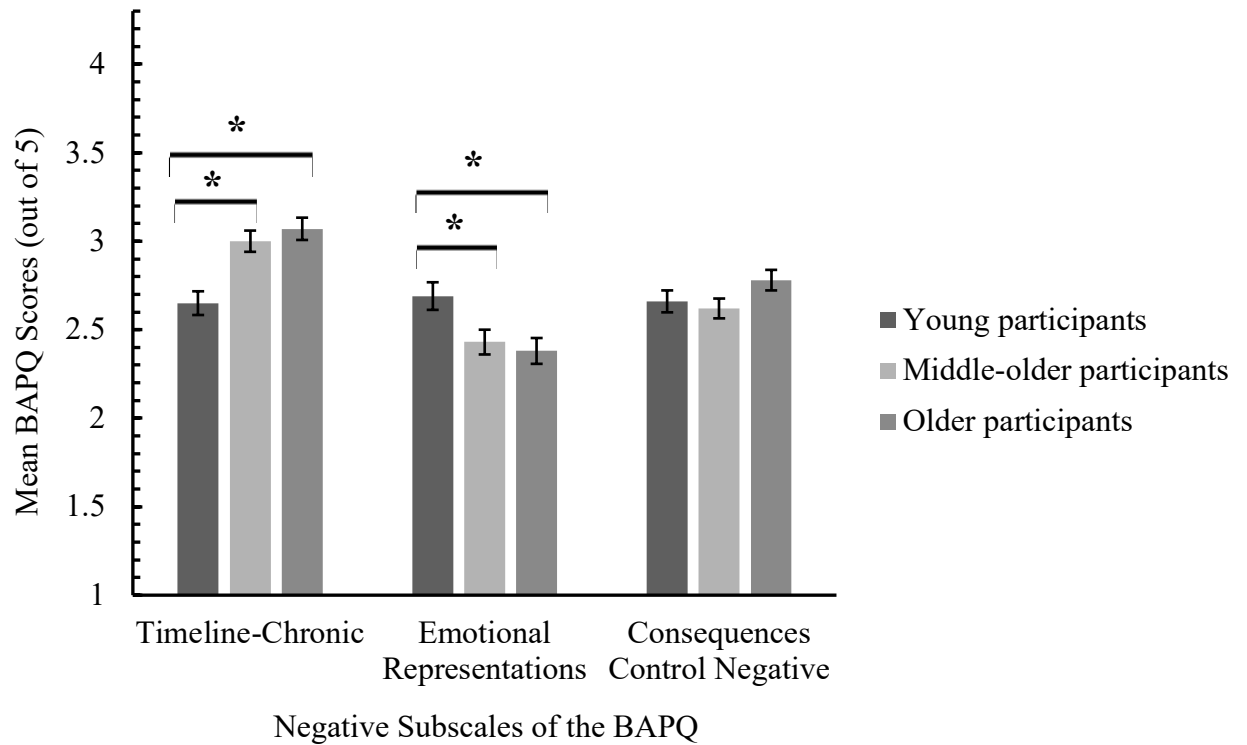


Figure 8. Mean scores (out of 5) on the three negative subscales of the Brief Aging Perceptions Questionnaire, as a function of participant age group. Higher scores represent more negative perceptions about aging. An asterisk denotes a significant difference between two mean scores.

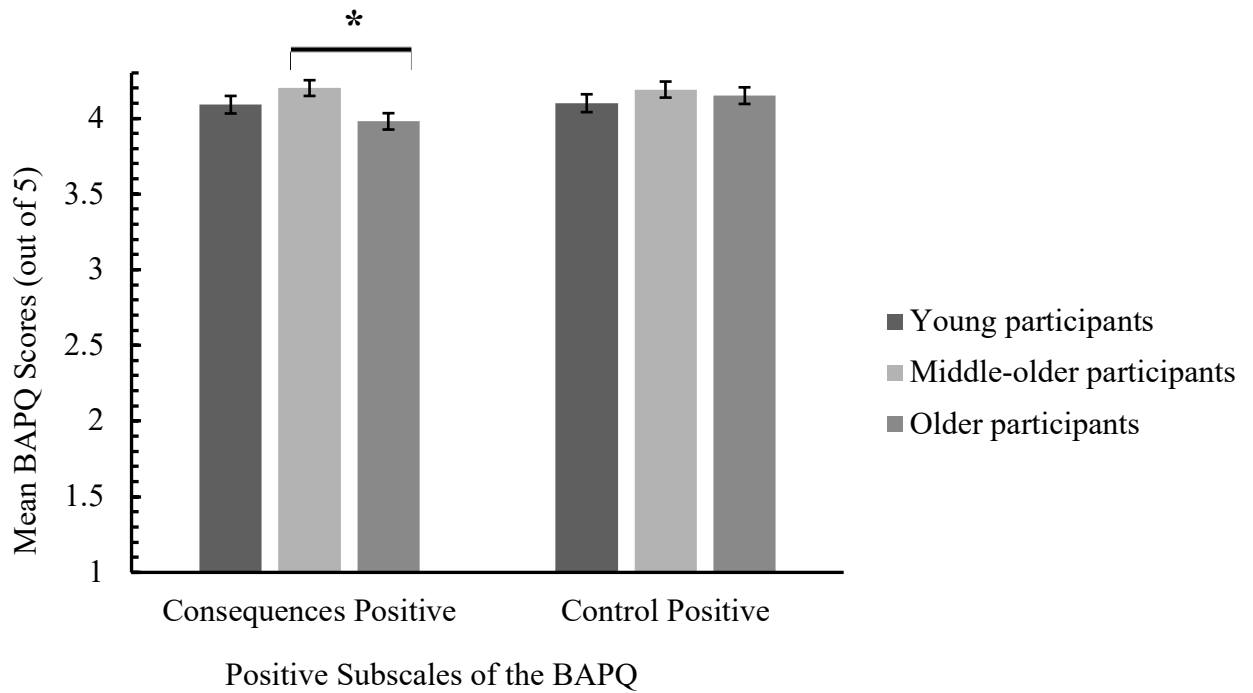


Figure 9. Mean scores (out of 5) on the two positive subscales of the Brief Aging Perceptions Questionnaire, as a function of participant age group. Higher scores represent more positive perceptions about aging. Error bars denote one standard error around the mean and an asterisk denotes a significant difference between two mean scores.

To investigate whether perceptions about aging were related to participants' emotion recognition performance on the GERT-S, mean GERT-S scores and mean total BAPQ scores were computed. To calculate GERT-S scores, the number of emotions that each participant correctly labelled were summed and converted into proportion accurate, separately for negative emotions and positive/neutral emotions. To calculate the total BAPQ scores, the two positive subscales ('Consequences Positive' and 'Control Positive') were reverse scored so that higher scores now represented more negative (or less positive) perceptions of aging. These scores were then summed with the other three negative subscales to form a total BAPQ score for each participant, with higher scores indicating more negative aging perceptions. Subsequently, participants were categorised as either

having more positive perceptions (all those with BAPQ scores below a median score of 2.354) or more negative perceptions (all those with BAPQ scores above 2.354).

GERT-S scores were then analysed in a 2 (emotion valence: negative, positive/neutral) x 3 (participant age group: young, middle-older, older) x 2 (perceptions of aging: more positive perceptions, more negative perceptions) mixed ANOVA. The ANOVA revealed a significant main effect of emotion valence, $F(1, 412) = 204.99, p < .001, \eta_p^2 = .33$, whereby participants were significantly worse overall at recognising negative emotions ($M = .49, SD = .15$) than positive/neutral emotions ($M = .61, SD = .16$).

This main effect was qualified by a significant interaction effect of emotion valence and participant age group, $F(2, 412) = 5.72, p = .004, \eta_p^2 = .03$, shown in Figure 10. To explore this interaction further, one-way ANOVAs were conducted for negative emotions and positive/neutral emotions separately, comparing the performance of participants across the three different age groups. For positive emotions, the ANOVA demonstrated that GERT-S scores did not significantly differ across participant age groups, $F(2, 415) = .68, p = .51, \eta_p^2 = .00$. However, for negative emotions, there was a significant effect of participant age group on the GERT-S scores, $F(2, 416) = 5.19, p = .006, \eta_p^2 = .02$. Post-hoc analyses using Bonferroni correction demonstrated that older adults ($M = .47, SD = .15$) were poorer than young adults ($M = .53, SD = .16$) at correctly recognising negative emotions, $p = .004$. Middle-older adults ($M = .49, SD = .14$) did not differ in accuracy from young adults or older adults when labelling negative emotions (both $ps > .05$).

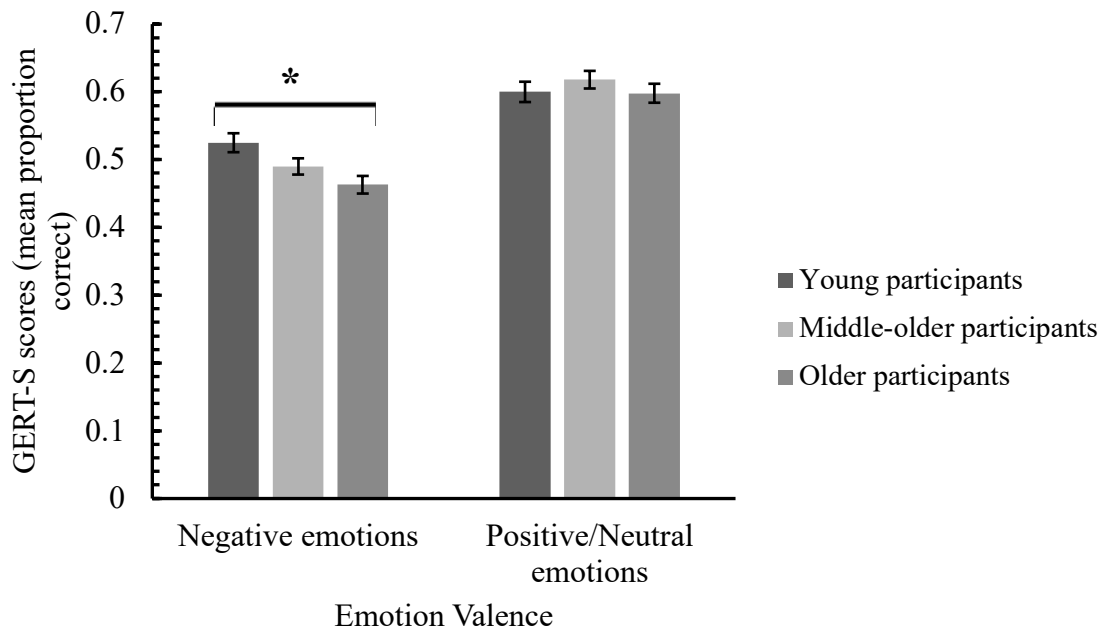


Figure 10. Mean proportion correct on the GERT-S for negative and positive/neutral emotions, as a function of participant age group. Error bars denote one standard error around the mean and an asterisk denotes a significant difference between two means.

Furthermore, there was a significant main effect of perceptions of aging, $F(1, 412) = 7.30, p = .007, \eta_p^2 = .02$, whereby people with more positive perceptions about aging were more accurate on the GERT-S ($M = .57, SD = .12$) than people with more negative perceptions about aging ($M = .53, SD = .15$)⁶. However, perceptions of aging did not significantly interact with emotion valence or participant age group (all $ps > .05$). These results suggest that the ability to accurately recognise emotions may be related to an individual's view of aging, but that this is the case for people of all ages, not just older adults.

⁶ Analysing these data using linear regression did not affect the reported outcomes.

Additional Analysis

An exploratory analysis was conducted to investigate whether participants who perceive emotion recognition ability to be a cognitive task, versus a social task, differed in their performance on the GERT-S. Participants were classified into a group of ‘social categorisers’ (who reported perceiving emotion recognition as predominantly a social task; $n = 243$) and ‘cognitive categorisers’ (those who reported perceiving it as a cognitive task; $n = 177$). Subsequently, GERT-S scores (proportion correct) were analysed in a 3 (age group: young, middle-older, older) x 2 (task categorisation: social, cognitive) x 2 (emotion valence: negative, positive/neutral) mixed ANOVA. Consistent with previous analyses, there was a main effect of emotion valence, $F(1, 412) = 185.32, p < .001, \eta_p^2 = .31$, qualified by an interaction between emotion valence and participant age group, $F(2, 412) = 6.89, p = .001, \eta_p^2 = .03$. There was also a trend such that cognitive categorisers ($M = .53, SD = .13$) performed worse on the GERT-S than social categorisers ($M = .56, SD = .14$), $F(1, 412) = 3.74, p = .05, \eta_p^2 = .01$. The three-way interaction between emotion valence, participant age group, and task categorisation did not reach significance, $F(2, 412) = 1.48, p = .23, \eta_p^2 = .01$.

However, although the three-way interaction was nonsignificant, examination of the interaction plots exhibited a trend in which young adults outperformed older adults at recognising negative emotions only for ‘cognitive’ but not ‘social’ categorisers. It is possible that a significant interaction effect may have been obscured by the use of an initial omnibus F test and reduced power (Hancock & Klockars, 1996). Therefore, for exploratory purposes, GERT scores were analysed in a 3 (participant age group: young, middle-older, older) x 2 (emotion valence: negative, positive/neutral) ANOVA, separately for ‘social categorisers’ and ‘cognitive categorisers’.

For participants who were cognitive categorisers, there was a significant main effect of emotion valence, $F(1, 173) = 81.28, p < .001, \eta_p^2 = .32$, such that participants were worse at recognising negative emotions ($M = .48, SD = .15$) than positive/neutral emotions ($M = .59, SD = .15$). This main effect was qualified by a significant interaction of emotion valence and participant age group, $F(2, 173) = 6.31, p = .002, \eta_p^2 = .07$. A follow-up one-way ANOVA comparing participant age groups' accuracy when recognising positive/neutral emotions indicated no difference in scores between young, middle-older, and older adults, $F(2, 173) = .49, p = .62, \eta_p^2 = .01$. However, for the recognition of negative emotions, there was a significant effect of participant age group, $F(2, 173) = 4.22, p = .02, \eta_p^2 = .046$, whereby older adults ($M = .45, SD = .16$) were less accurate than young adults ($M = .53, SD = .14$), $p = .02$. Middle-older adults' GERT-S scores ($M = .465, SD = .157$) were not significantly different from young or older adults ($ps > .05$).

For participants who were social categorisers, there was a significant main effect of emotion valence, $F(1, 239) = 112.91, p < .001, \eta_p^2 = .32$, such that participants had lower accuracy scores for negative emotions ($M = .51, SD = .15$) than positive/neutral emotions ($M = .62, SD = .17$) on the GERT-S. However, there was no significant interaction effect of emotion valence and age group, $F(2, 239) = 1.31, p = .27, \eta_p^2 = .01$.

Therefore, the finding that older adults were worse than young adults at recognising negative emotions on the GERT-S held for 'cognitive categorisers' but not for 'social categorisers.' These results may provide some preliminary evidence that older adults perform worse than young adults only when they view emotion recognition as a cognitive task (which they are stereotypically assumed to be worse at), but not if they view it as a social task (at which they are expected to perform equally to young adults). However, given that these analyses were conducted using self-reported belief and the initial omnibus F test did not reach significance, they should be interpreted with caution.

Discussion

The first objective of the current study was to explore the current stereotypes about aging in the USA. In line with previous research and reviews (e.g., Kite et al., 2005; Posthuma & Campion, 2009; Swift et al., 2013), the present results indicated that people hold several negative stereotypes about declines in competency with age. For example, older adults (aged 75 years) were believed to be less competent than young adults (aged 25) at driving, learning new skills, using the internet, completing memory tasks, completing computer tasks, and participating in a running race. However, they also held various positive stereotypes about aging, such as that older adults are better at making financial decisions and imparting knowledge and wisdom. With regards to present study's main areas of interest, a stereotype shared by most participants was that older adults are worse than young adults at completing cognitive tasks. On the other hand, older adults were believed to be as good as young adults at social interaction.

On task domains relating to emotion recognition, there was a perception that older adults were equally – or even *more* – competent than young adults. For example, the majority of participants (across all age groups) believed that older adults were equal to or better than young adults at recognising emotions in faces, understanding how someone is feeling or what they are thinking, understanding others' emotional body language, and recognising the emotion in somebody's tone of voice. Very few participants believed that young adults were more competent than older adults on these tasks. This main finding is remarkable considering the literature showing that older adults are in fact poorer than young adults at recognising many emotions (Ruffman et al., 2008). Unlike age-related stereotypes about memory difficulties, cognitive decline, and deterioration in physical ability, it appears that stereotypes about emotion recognition ability across the lifespan are in the opposite direction to what has been established by empirical research. It is possible,

then, that older adults' lack of knowledge about age-related declines in emotion recognition ability might protect them from being threatened by the implication that they will perform worse on emotion recognition tasks. Further, the finding that very few people actually believe young adults to be more competent at recognising emotions may explain why the stereotype threat manipulation in Study 1 led to young adults feeling highly threatened and anxious.

A related finding was that middle-older and older adults were equally likely to consider emotion recognition to be a cognitive or a social task, and that young adults were actually *more* likely to view it as a social task. The fact that a) participants in the current study believed that older adults are just as competent as young adults in the domain of social interaction, and b) many of the participants view emotion recognition as a social task, may partially explain why lay people do not expect older adults to be worse at recognising emotions.

The second objective of the current study was to investigate whether young, middle-older, and older adults' perceptions of aging were related to their performance on an emotion recognition task. Initial comparisons of aging perceptions between the three participant age groups resulted in three main findings. Firstly, middle-older and older adults were shown to have more negative perceptions about the chronicity of aging than young adults. This is unsurprising given that one would expect both older participant age groups to be more likely than young adults to categorise themselves as "old", to be cognizant of aging, and to "feel their age" in daily activities. Indeed, research has shown that many older adults report feeling old and tired (Harris, 1975), and that they report feeling older with increasing age (Kotter-Grühn, Kleinsphen-Ammerlahn, Gerstorff, & Smith, 2009).

Secondly, older adults were found to have less positive perceptions about the consequences of aging than middle-older adults. This is consistent with previous research showing that satisfaction with aging declines with age in older adults (Kleinspenn-Ammerlahn, Kotter-Grühn, & Smith, 2008; Kotter-Grühn et al., 2009). One potential explanation for this is that middle-older adults may have more optimistic (perhaps wishful) expectations that reaching older age will result in positive outcomes, such as becoming wiser, developing further as a person, and becoming more appreciative of things in life. It is possible that, once adults actually reach older age and begin to experience more age-related difficulties, they have a less positive outlook of the good outcomes of aging.

Finally, compared to middle-older and older adults, young adults were shown to experience more negative emotional responses (such as depression, anxiety, and anger) when thinking about aging and how it might affect them. This finding possibly reflects ageism and negative stereotypes from young adults towards their older counterparts. Because young adults perceive older adults to be less competent in a number of task domains (as was corroborated in the present study), it is conceivable that they would experience a negative emotional response when considering becoming part of the stigmatized age group. Middle-older and older adults, on the other hand, may have become better at regulating negative emotional responses by choosing to switch their focus towards the positive, meaningful aspects of life due to anticipated limits on their lifespan (in line with the socioemotional selectivity theory; Carstensen, Fung, & Charles, 2003).

With regard to young, middle-older, and older adults' performance on the GERT-S, the results were in line with previous findings of age-related differences in emotion recognition ability. Despite employing a dynamic, multimodal emotion recognition task (the GERT-S), older adults were still poorer at recognising negative emotions than young adults (with middle-older adults scoring somewhere in the middle). However, older adults

were equally good as young adults at recognising positive/neutral emotions. These findings are consistent with previous research showing that older adults' ability to recognise negative emotions such as fear, anger, and sadness is impaired (Ruffman et al., 2008) while the ability to successfully recognise positive emotions may be somewhat spared (Murphy, Lehrfeld, & Isaacowitz, 2010). Although Ruffman and colleagues' (2008) meta-analysis indicated that young adults were better than older adults at recognising happiness, the effect size found was very small. In addition, the 95% confidence interval included zero, suggesting that older adults' accuracy when recognising positive emotions (such as happiness) may not actually differ significantly from young adults (Murphy et al., 2010). The current study's results support this idea.

Across all three participant groups, those with more positive perceptions of aging were more accurate on the GERT-S than those with more negative perceptions. It is unclear why this effect occurred irrespective of participant age. One possible explanation is that thinking pessimistically about aging led all participants (regardless of age) to experience temporarily lowered mood, which may have reduced their emotion recognition performance. This would be consistent with previous research showing that psychological distress or depression may be associated with lowered emotion recognition accuracy (Csukly et al., 2011; Persad & Polivy, 1993; Surguladze et al., 2004).

Alternatively, it is possible that participants who are more optimistic and positive about aging also have higher levels of empathy, which could improve their emotion recognition performance. Indeed, studies have respectively demonstrated that optimism and empathy may be closely interrelated (Hojat, Vergare, Isenberg, Cohen, & Spandorfer, 2015), and that empathy may be positively related to emotion recognition ability (Gery, Miljkovitch, Berthoz, & Soussignan, 2009). However, because the present study did not include measures of current mood or empathy, a conclusive explanation for this finding is

unable to be made. With regard to future directions, a longitudinal study investigating whether older adults' perceptions of aging are positively or negatively associated with emotion recognition over time might be more informative.

In addition to the above primary analyses, a further rudimentary analysis was conducted to explore age differences on the GERT-S separately for those who perceive emotion recognition to be predominantly a cognitive task (i.e., cognitive categorisers) and those who perceive it to be a social task (i.e., social categorisers). It was found that age-related differences on the GERT-S remained only for cognitive categorisers, but not for social categorisers. Although caution should be used when interpreting this finding (as categorisation was not experimentally manipulated), it provides a tentative suggestion that the way emotion recognition is perceived or framed may affect older adults' emotion recognition ability. For example, perceiving emotion recognition as a cognitive task may lead to stereotype threat in older adults due to the societal stereotypes about age-related cognitive decline. On the other hand, perceiving emotion recognition to be a social task may not affect older adults' ability to recognise emotions. This idea was explored further in Study 3.

CHAPTER FOUR

Study Three: Potential Effects of Framing an Emotion Recognition Task as a Cognitive Task on Older Adults' Emotion Recognition Ability

The results of Study 1 showed that eliciting stereotypes about age-related declines in emotion recognition was not successful in inducing stereotype threat in older adults, and in fact, appeared to induce stereotype threat in *young* adults. One possible explanation for this finding is that lay people do not actually believe that emotion recognition ability declines with age (as demonstrated in Study 2), despite the literature demonstrating so (Gonçalves et al., 2018; Ruffman et al., 2008). Therefore, the main objective of Study 3 was to employ a more effective stereotype threat manipulation based on aging stereotypes that *are* prevalent in current western society. Given that older adults are believed to have worse cognitive functioning than young adults (as supported by findings from Study 2), framing emotion recognition as a cognitive task may produce stereotype threat effects in older adults. Because older adults are believed to be equally good as young adults in the domain of social interaction (also shown in Study 2), framing emotion recognition as a social task should not produce stereotype threat.

Therefore, in the current study, young (aged 18-30 years) and older (aged over 65 years) adults were assigned to one of three conditions: cognitive, social, or control. In both the cognitive and social conditions, participants were informed that young and older adults were going to be compared, whereas participants in the control condition were simply told that different types of people were taking part. Additionally, the emotion recognition task

was framed as assessing cognitive ability in the cognitive condition, and as assessing social ability in the social condition. In the control condition, participants were told that the aim of the study was to assess people's abilities on various tasks. Participants then completed the same emotion recognition task used in Study 2 (the GERT-S).

Subsequently, participants answered two explicit questions about how stereotype-threatened they had felt while completing the task.

Participants also completed the Age Group Identification Scale – Shortened Version (AGIS; Gartska, Branscombe, & Hummerts, 1997), which was used to measure the degree to which participants identify with their own age group. Previous research has shown that stereotype threat manipulations can have differing effects on one's task performance depending on the degree to which one identifies with a group that they belong to. For example, Schmader (2002) demonstrated that, compared to women who identified weakly with their gender, women who identified strongly with their gender experienced greater impairments on a math test as a result of stereotype threat about women's math ability. In addition, Deaux and colleagues (2007) found that stereotype threat had greater effects on the academic success of Afro-Caribbean immigrants in America who identified more with being African-American, compared to those who identified more with being West Indian (and thus might be less targeted by racial stereotypes about African-American people's academic ability). These effects have been explained in terms of social identity theory (Tajfel, 2010), whereby people who identify strongly with a particular group have an increased tendency to experience stereotype threat when their social identity is threatened (Marquet et al., 2019).

More relevant to the current thesis, the degree of identification with one's age group has also been shown to affect older adults' performance on stereotype-relevant tasks (Kang & Chasteen, 2009; Marquet, Missotten, Dardenne, & Adam, 2019). For example,

Kang and Chasteen (2009) found that older adults who strongly identified with the older age group had worse memory for prose compared to older adults who identified less strongly with their age group. Interestingly, this effect was independent of experimentally manipulated stereotype threat, suggesting that older adults who have worse memories may increase their identification with the stigmatised age group in order to receive support from other members (Kang & Chasteen, 2009). Alternatively, cues relating to older adults' competency on cognitive tasks (such as memory) may be more salient to those who identify strongly with their age group, even in low-threat conditions (Kang & Chasteen, 2009). Taking this research into account, another objective of the present study was to explore whether the degree to which young and older adults identify with their own age group has any direct or moderating effects on their emotion recognition accuracy.

The first main hypothesis of the current experiment was that, due to prevalent stereotypes about cognitive decline with age, older adults would report being more threatened in the condition in which emotion recognition was framed as a cognitive task, compared to the social and control conditions. As a result of this stereotype threat, it was expected that older adults would experience a performance deficit on the emotion recognition task in the cognitive condition, relative to the other two conditions. Conversely, it was hypothesised that young adults' reported level of stereotype threat and performance on the GERT-S would remain constant across the three conditions.

With regard to age group identification, it was considered possible that either: 1) older adults who identify strongly with their age group would experience greater deleterious effects of stereotype threat on emotion recognition accuracy, compared to those who identify weakly (in line with studies such as Deaux et al., 2007; Schmader, 2002), or 2) older adults who identify strongly with their age group would be less accurate at recognising emotions than those who identify weakly, regardless of stereotype threat

condition (in line with Kang & Chasteen, 2009). As young adults were not the target of the stereotype threat, it was expected that age group identification would not have any direct or moderating effect on their emotion recognition performance.

Method

Participants

One hundred and twenty-two young adults (68 male) aged 18 – 30 ($M = 25.82$ years, $SD = 3.05$ years) and 117 older adults (52 male) aged 65 – 88 ($M = 69.47$ years, $SD = 4.44$ years) from the United States of America participated in the present study (after the application of exclusion criteria, which are described in the results). As in Study 2, Amazon Mechanical Turk was used to recruit participants (i.e. MTurk ‘workers’), who received \$0.90 to \$1.00 for taking the present 20-30-minute survey. All participants reported being proficient in English and reported no dementia or other neurological difficulties. Ethical approval was obtained from the Human Ethics Committee (Reference number = D17/006) and all participants provided informed consent before participating in the study.

Stimuli and Measures

The Geneva Emotion Recognition Test – Short Version (GERT-S). As described in the previous chapter, the GERT-S is a 42-item emotion recognition task that requires participants to assign an emotion label (from 14 options: pride, joy, amusement, pleasure, relief, interest, surprise, anxiety, fear, despair, sadness, disgust, irritation, and anger) to male and female actors’ emotional portrayals in short video clips.

Age Group Identification Scale – Shortened Version. The short version of the AGIS (Garstka, Branscombe, & Hummerts, 1997) was used in the present study to assess the extent to which participants identify with their own age group. The scale consists of 5 items such as “I like being a member of my age group”, and “My age group membership is

central to who I am”. Participants responded to these items using a scale from 1 (strongly disagree) to 7 (strongly agree), with higher scores indicating a greater level of identification with their age group. The full 13-item version of the AGIS has previously been shown to have excellent internal consistency (Cronbach’s $\alpha = .97$; Kang & Chasteen, 2009).

The Depression Anxiety Stress Scales-21 (DASS-21). As in the previous studies, the DASS-21 was employed as a screen for depression, anxiety, and stress. Participant data was not included in any data analyses if their scores on the DASS-21 exceeded the cut-off for severe depression, anxiety, or stress.

Procedure

Once participants clicked the link provided to them on the MTurk website, they were presented with the present survey via Qualtrics. After being provided with a broad overview of the study, participants answered two questions about their age and their gender (see Appendix H). If participants were within the target age groups for the study, they were informed that they were eligible and could continue on to read the full information sheet. At this point, participants were randomly assigned to one of three conditions (cognitive, social, or control), and were subsequently presented with a study description that contained slightly different information depending on their assigned condition (see Appendix I and Appendix J).

In the cognitive condition, the recognition of emotions was framed as a task that assesses cognitive ability, with participants being told that “the purpose of this study is to examine people’s cognitive ability at different ages” and that young and older adults were being compared. In the social condition, participants were told that “the purpose of this study is to examine people’s social ability at different ages” and that young and older adults were being compared. Finally, in the control condition, they were told that “the

purpose of this study is to examine people's ability on various tasks", and that different types of people would be taking part in the research (i.e. no mention of age group comparisons).

Once participants had been informed about the study and had provided consent (see consent form in Appendix K), the manipulation was reinforced by stating to participants in the cognitive condition that "the following tasks will assess your cognitive ability", while participants in the social condition were told that "the following tasks will assess your social ability." Those in the control condition were merely told that "the following tasks will assess your abilities in various domains." Participants then continued on to complete the GERT-S. After finishing the GERT-S, participants were asked whether the video clips and audio worked correctly throughout the test (and if they did not, their data were excluded from analyses).

Next, participants' explicit stereotype threat concerns were assessed using the two questions utilised in Study 1 (i.e., "Were you worried that your ability to perform well on these tasks was affected by your age?" and "Were you worried that if you performed poorly on the test, the researcher would attribute your poor performance to your age?"). They were required to respond using a scale from 1 (not at all) to 7 (very much). Subsequently, participants answered a series of demographic questions about age, ethnicity, level of education, proficiency in the English language, current medication, and neurological difficulties (see Appendix L). Participants then completed the AGIS, followed by the DASS-21.

Finally, as a manipulation check, participants were asked whether they remembered what the study was originally described as assessing. To discourage guessing, they were told that "if you don't remember how we described it to you, it is ok to say you don't remember." Participants were required to select one of the following responses: 1) "I

was told that the study was assessing people's cognitive ability at different ages", 2) "I was told that the study was assessing people's social ability at different ages", 3) "I was told that the study was assessing people's abilities on various tasks (no mention of age-related differences), or 4) "I don't remember."

Results

Exclusion Criteria

A total of 8,823 MTurk workers clicked the link to the eligibility screen, but only 6.3% of workers ($n = 558$) met the age requirements. Participants' data were excluded the study if they: reported taking medication for a mental health problem; were above the DASS-21 cut-off for extremely severe depression, anxiety, or stress; reported suffering from neurological problems; indicated that any of the GERT videos did not work correctly; responded incorrectly to the manipulation check; or did not complete the survey. After the exclusion criteria were applied, the remaining participants included 122 young adults (68 male) aged 18-30 years old ($M = 25.82$, $SD = 3.05$) and 117 older adults (52 male) aged 65-88 years old ($M = 69.47$, $SD = 4.44$).

Preliminary Analyses

DASS-21 scale scores (along with average highest level of education) are displayed in Table 8, separately for each age group and gender. To explore possible differences in DASS-21 scores, participants' scores on the depression, anxiety and stress scales were examined in a 2 (participant age group: young, older) x 2 (gender: female, male) MANOVA. The analysis revealed a main effect of participant age group for the depression scale, $F(1, 234) = 10.89$, $p = .001$, $\eta_p^2 = .04$, the anxiety scale, $F(1, 234) = 12.97$, $p < .001$, $\eta_p^2 = .05$, and the stress scale, $F(1, 234) = 15.67$, $p < .001$, $\eta_p^2 = .06$, with young adults scoring higher than older adults on each. However, there were no main effects of gender (all $ps > .05$).

For each DASS-21 scale, the main effect of participant age group was qualified by a significant interaction between participant age group and gender (depression: $F(1, 234) = 4.65, p = .03, \eta_p^2 = .02$; anxiety: $F(1, 234) = 7.95, p = .005, \eta_p^2 = .03$; stress: $F(1, 234) = 5.24, p = .02, \eta_p^2 = .02$). To explore the interaction effects further, independent samples *t*-tests were used to compare male and female participants' scores on each DASS-21 scales, separately for young and older participants. These tests were conducted using Bonferroni adjusted alpha levels of .017 per test (.05/3). For each of the three DASS-21 scales, the analyses demonstrated that although young males had lower scores than young females and older males had higher scores than older females, none of these differences reached statistical significance (all $ps > .017$).

To determine whether education level differed between participant age groups and genders, average level of education was analysed in a 2 (participant age group: young, older) x 2 (gender: female, male) ANOVA. There were no main effects of participant age group or gender, nor an interaction between the two variables (all $ps > .05$).

Table 8.

Education Level and Screening Questionnaire Means (*SDs*) for Young and Older Adults in Study 3

	Young Adults		Older Adults	
	Female	Male	Female	Male
Education	4.87 (1.62)	5.31 (1.49)	5.45 (1.62)	5.44 (1.49)
DASS-21 Depression Scale	7.32 (7.79)	6.29 (6.49)	2.80 (4.46)	5.34 (6.53)
DASS-21 Anxiety Scale	5.74 (5.96)	3.79 (4.73)	2.06 (2.71)	3.35 (3.65)
DASS-21 Stress Scale	9.58 (7.19)	7.47 (6.92)	4.37 (4.82)	6.08 (6.54)

Notes. Education level was categorised as 1 = primary school, 2 = some high school, 3 = high school, 4 = trade certificate, 5 = technical certificate, 6 = an undergraduate university degree, and 7 = postgraduate.

Consistent with Study 1 and Study 2, neither gender nor DASS-21 scores were included in the following analyses. Data from the current study were primarily analysed using ANOVAs, with Huynh-Feldt corrected values reported if Mauchly's Test showed the assumption of sphericity to be violated. Where necessary, interactions revealed by ANOVAs were further analysed using *t*-tests, with the Bonferroni correction applied for multiple comparisons. Levene's Test for Equality of Variances was also employed, and corrections subsequently made for any unequal variances.

Threat-Based Concerns Across Conditions

A Pearson correlation coefficient was computed to assess the correlation between the two questions about threat-based concerns ("Were you worried that your ability to perform well on these tasks was affected by your age?" and, "Were you worried that if you

performed poorly on the test, the researcher would attribute your poor performance to your age?”). The analysis demonstrated that participants’ responses on the 7-point scale for the two questions were significantly positively correlated, $r = .66$, $n = 239$, $p < .001$; therefore, responses for the two questions were averaged to create a single threat score for each participant.

Participants’ threat scores were then examined in a 2 (participant age group: young, older) x 3 (condition: control, cognitive, social) analysis of variance (ANOVA), revealing a significant main effect of condition, $F(2, 233) = 3.88$, $p = .02$, $\eta_p^2 = .03$. According to post-hoc comparisons using the Bonferroni correction, self-reported threat scores were significantly higher in the cognitive condition ($M = 2.20$, $SD = 1.60$) compared to the control condition ($M = 1.64$, $SD = 1.19$), $p = .02$. Threat scores did not significantly differ between the cognitive condition and the social condition ($M = 1.88$, $SD = 1.15$), $p = .40$, nor between the social condition and the control condition, $p = .76$.

As shown in Figure 11, the main effect of condition on threat scores was qualified by an interaction between condition and participant age group, $F(2, 233) = 4.85$, $p = .009$, $\eta_p^2 = .04$. To explore the interaction further, one-way ANOVAs were conducted that compared threat scores between conditions, separately for young and older participants. For young adults, there was no main effect of condition on threat scores, $F(2, 119) = .11$, $p = .90$, $\eta_p^2 = .00$. However, for older adults, the effect of condition on threat scores was significant, $F(2, 114) = 8.95$, $p < .001$, $\eta_p^2 = .14$. Post-hoc comparisons demonstrated that older adults were significantly more threatened in the cognitive condition ($M = 2.57$, $SD = 1.74$) than both the social ($M = 1.81$, $SD = 1.05$), $p = .03$, and control conditions ($M = 1.38$, $SD = .74$), $p < .001$. There was no significant difference in self-reported threat between the social and control conditions, $p = .45$. Evidently, the stereotype threat manipulation was effective in producing higher levels of stereotype threat in older adults when the task was

framed as measuring an aspect of cognitive functioning (which is widely believed to decline with age).

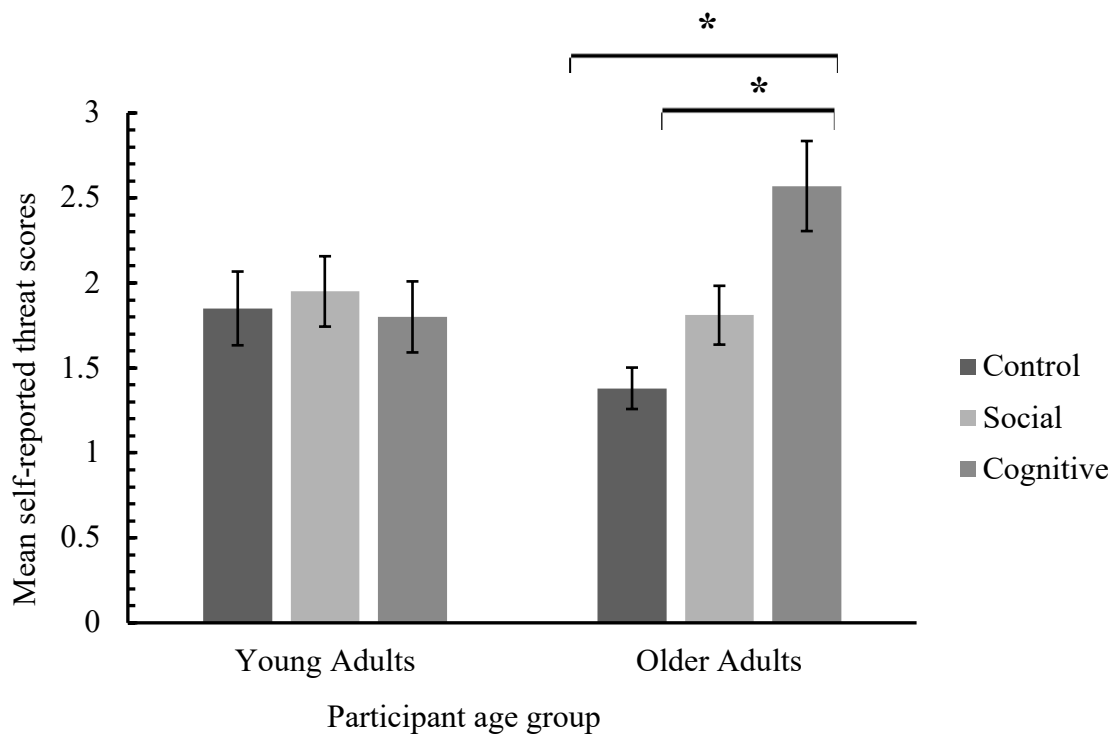


Figure 11. Mean self-reported threat scores as a function of participant age group and stereotype threat condition. Error bars denote one standard error around the mean and asterisks signify a significant difference in mean scores between conditions.

Effect of Stereotype Threat Condition on Young and Older Adults' Emotion

Recognition Accuracy

Separate negative and positive/neutral GERT-S scores were generated for each participant by calculating the respective proportion of negative and positive/neutral emotions that they correctly labelled. Then, GERT-S scores were analysed in a 2 (emotion valence: negative, positive/neutral) x 2 (participant age group: young, older) x 3 (condition: control, cognitive, social) mixed ANOVA. A significant main effect of emotion valence was discovered, indicating that participants were poorer at correctly

labelling negative emotions ($M = .50$, $SD = .15$) than positive/neutral emotions ($M = .61$, $SD = .16$), $F(1, 233) = 126.41$, $p < .001$, $\eta_p^2 = .35$.

This effect was qualified by an interaction of emotion valence and participant age group, $F(1, 233) = 6.54$, $p = .01$, $\eta_p^2 = .03$, displayed in Figure 12. Independent t -tests were conducted to investigate how negative and positive/neutral GERT-S scores differed between participant age groups. For negative emotions, GERT-S scores did not significantly differ between young adults ($M = .50$, $SD = .16$) and older adults ($M = .49$, $SD = .14$), $t(237) = .12$, $p = .90$. Interestingly, however, older adults were *more* accurate at recognising positive/neutral emotions ($M = .64$, $SD = .13$) compared to young adults ($M = .58$, $SD = .17$), $t(223.39) = 2.71$, $p = .007$.

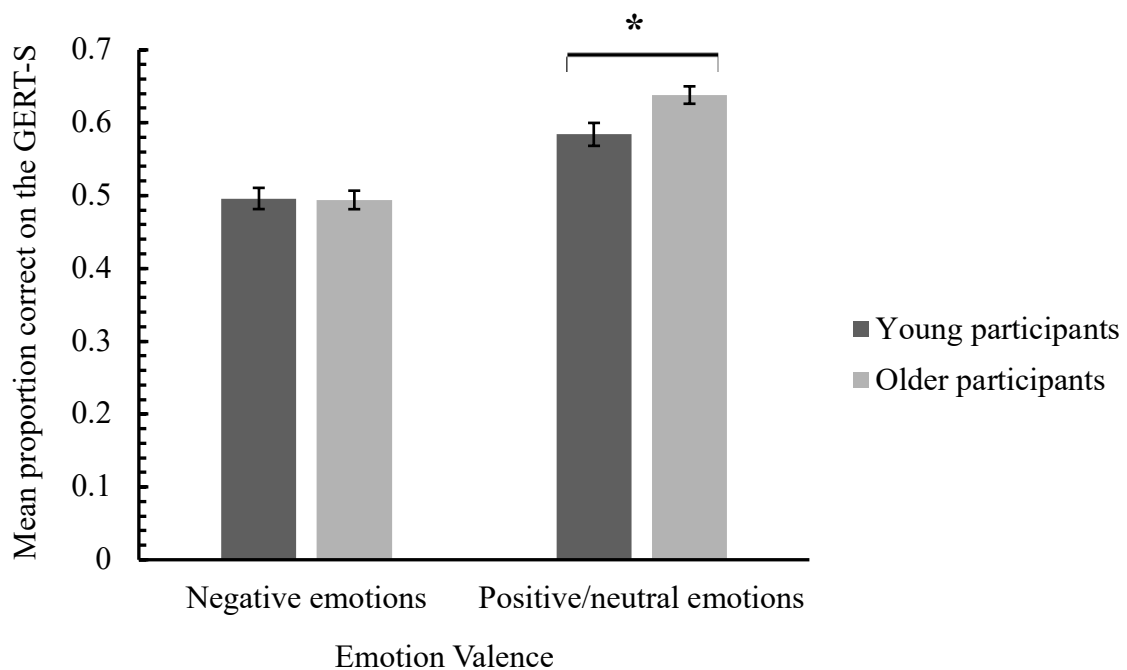


Figure 12. Mean proportion correct on the GERT-S for negative and positive/neutral emotions, as a function of participant age group. Error bars denote one standard error around the mean and the asterisk signifies a significant difference between participant age group means.

Importantly for the current research hypotheses, there were no significant effects of stereotype threat condition on GERT-S scores (all $ps > .05$; see Table 9 for all ANOVA results including stereotype threat condition as a variable). It appears that young and older adults' ability to recognise emotions did not vary as a function of whether they were told that the task was assessing general ability, social ability, or cognitive ability. Therefore, despite the stereotype threat manipulation effectively increasing older adults' self-reported threat, their performance on the emotion recognition task was not affected.

Table 9.

ANOVA Results for Main and Interaction Effects on GERT-S Accuracy Scores (Proportion Correct) Involving Stereotype Threat Condition

Source	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η_p^2
Condition	2	.03	.78	.46	.01
ParticipantAge*Condition	2	.02	.59	.56	.01
EmotionValence*Condition	2	.03	2.70	.07	.02
EmotionValence*ParticipantAge*Condition	2	.01	.62	.54	.01

Young and Older Adults' Age Group Identification Scale (AGIS) Scores

Responses for each of the five AGIS items, ranging from 1 to 7, were calculated for each participant and then averaged across young and older adults separately. An analysis of the reliability of the AGIS demonstrated a Cronbach's alpha of .91, indicating a high level of internal consistency between the five items. As shown in Table 10, participants' responses on the five items were all significant positively correlated. Consequently, responses on the five items were averaged to create a single age group

identification score for each participant, with higher scores indicating a greater level of identification with their own age group. A one-way ANOVA revealed that AGIS scores did not differ between young adults ($M = 5.00$, $SD = 1.47$) and older adults ($M = 5.02$, $SD = 1.32$), $F(1, 237) = .00$, $p = .96$, $\eta_p^2 = .00$.

Table 10.

Correlations Between Five Items of the Age Group Identification Scale

Item	1.	2.	3.	4.	5.
1. I like being a member of my age group	–				
2. I am proud to be a member of my age group	.804**	–			
3. My age group membership is central to who I am	.536**	.582**	–		
4. I believe that being a member of my age group is a positive experience	.754**	.791**	.608**	–	
5. I have a clear sense of my age group identity and what it means to me	.567**	.677**	.620**	.667**	–

** $p < .01$.

To determine whether age group identification differentially affected young and older adults' performance on the GERT-S, participants were split into low and high age group identifiers. This was performed as a median split, where all participants whose AGIS scores fell below the median (< 5.2) were categorised as "low identifiers" and those whose scores fell above the median (> 5.2) were categorised as "high identifiers." An initial ANOVA included stereotype threat condition as a variable; however, there were no significant effects of condition (all $ps > .05$). Consequently, stereotype threat condition was not included in the following analysis.

GERT-S scores were analysed in a 2 (emotion valence: negative, positive/neutral) x 2 (participant age group: young, older) x 3 (age group identification: low, high) ANOVA. Consistent with the results previously described (and in the same direction), the ANOVA revealed a main effect of emotion valence, $F(1, 217) = 119.60, p < .001, \eta_p^2 = .36$, qualified by an interaction of emotion valence and participant age group, $F(1, 217) = 6.71, p = .01, \eta_p^2 = .03$.

As shown in Figure 13, a significant two-way interaction was observed between participant age group and age group identification, $F(1, 217) = 6.49, p = .01, \eta_p^2 = .03$, whereby older adults who identified more strongly with their age group were less accurate on the GERT-S than those who identified weakly, whereas the opposite was true for young adults. To investigate the effect further, independent samples *t*-tests were conducted that compared low and high age group identifiers' emotion recognition accuracy on the GERT-S for young and older adults separately. This analysis confirmed that, for older adults, high identifiers ($M = .55, SD = .11$) were less accurate at recognising emotions than low identifiers ($M = .59, SD = .10$), although the effect just failed to reach significance, $t(110) = 1.96, p = .05$. For young adults, the opposite was found, with high identifiers being more accurate ($M = .57, SD = .12$) than low identifiers ($M = .51, SD = .18$), albeit non-significantly once again, $t(94.08) = 1.91, p = .06^7$.

⁷ Analysis of these data with linear regression showed similar effects that, as with the *t*-tests described above, approached significance.

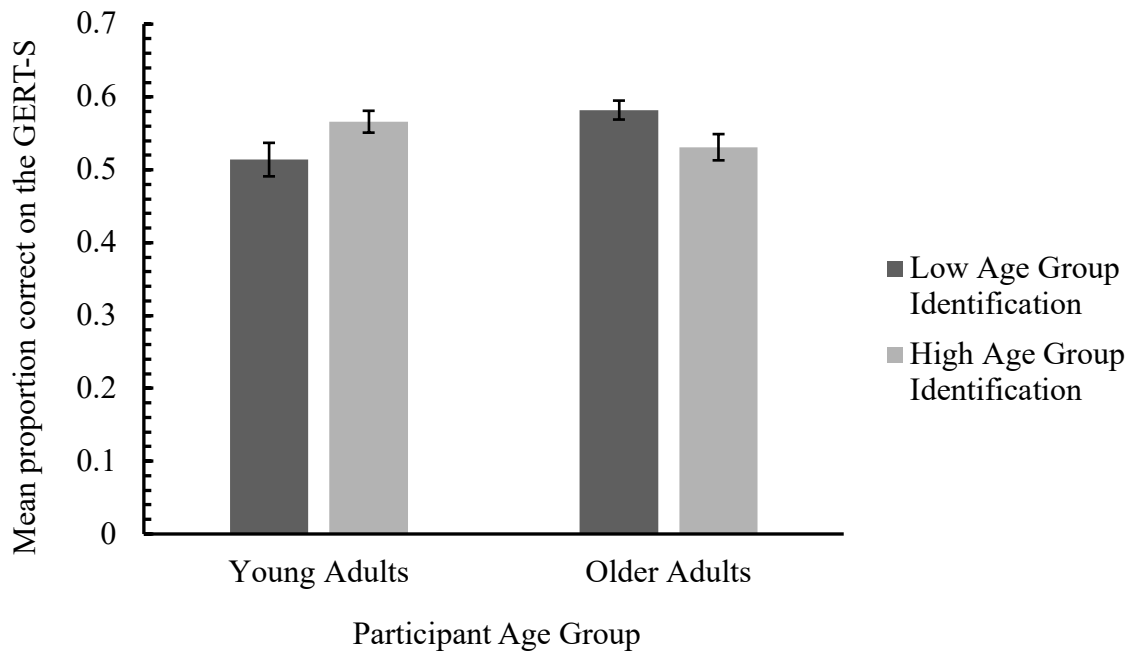


Figure 13. Young and older adults' GERT accuracy scores (mean proportion correct) for high age group identifiers and low age group identifiers. Error bars denote one standard error around the mean.

Additional Analysis

Combined analysis of GERT-S data from Study 2 and Study 3. The current study's primary research focus was on the potential effects of stereotype threat on emotion recognition ability, and not age-related differences in emotion recognition ability specifically. Despite this, it was considered beneficial to further investigate the current finding that older adults were equally good as young adults at recognising negative emotions and actually *better* at recognising positive emotions (contrary to empirical research; e.g., Ruffman et al., 2008). Given that Study 2 and Study 3 employed the exact same GERT-S emotion recognition programme, data from both studies were combined (for young and older adults only; middle-older adults from Study 2 were excluded) to investigate the overall effects of participant age group on emotion recognition accuracy.

GERT-S scores were analysed in a 2 (emotion valence: negative, positive/neutral) x 2 (study: Study 2, Study 3) x 2 (participant age group: young, older) ANOVA, which revealed a significant main effect of emotion valence, $F(1, 500) = 245.03, p < .001, \eta_p^2 = .33$, with participants being less accurate at recognising negative emotions ($M = .50, SD = .16$) than positive emotions ($M = .61, SD = .16$). The ANOVA also revealed an interaction between study and age group, $F(1, 500) = 5.12, p = .02, \eta_p^2 = .01$. Further exploration using t -tests indicated that, for young participants, there was no significant difference between GERT-S scores in Study 2 ($M = .56, SD = .15$) and Study 3 ($M = .54, SD = .15$), $t(243) = 1.02, p = .31$. However, older participants from Study 3 were more accurate at recognising emotions ($M = .57, SD = .11$) compared to older participants in Study 2 ($M = .54, SD = .13$), although this effect just failed to reach significance (according to the applied Bonferroni p value of .025), $t(257.95) = 2.10, p = .04$.

Importantly, an interaction between emotion valence and participant age group was found, $F(1, 500) = 17.03, p < .001, \eta_p^2 = .03$, which did not depend on the study in which participants completed the GERT-S (i.e., there was no three-way interaction between study, emotion valence, and participant age group, $F(1, 500) = .02, p = .89, \eta_p^2 = .00$). The interaction between emotion valence and participant age group (depicted in Figure 14) was further explored by comparing young and older participants' GERT-S scores separately for negative and positive/neutral emotions. When recognising positive/neutral emotions, older adults ($M = .62, SD = .15$) were equally as accurate as young adults ($M = .59, SD = .17$), $t(476.9) = 1.77, p = .08$. However, older adults performed more poorly ($M = .48, SD = .15$) than young adults ($M = .51, SD = .16$) when recognising negative emotions, $t(502) = 2.34, p = .02$.

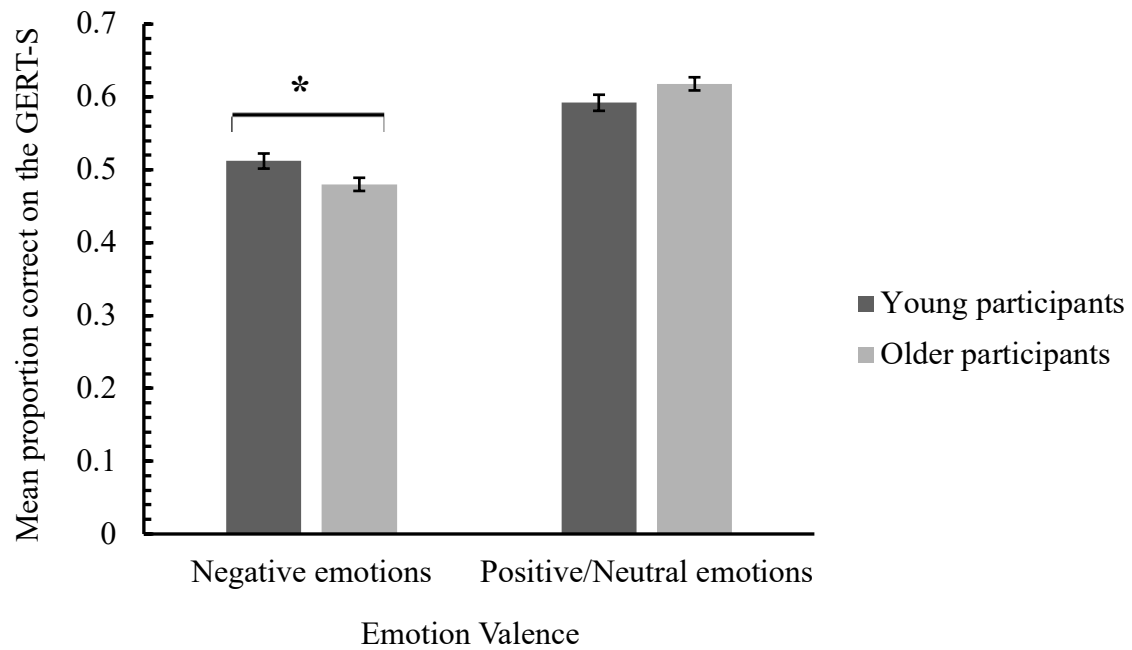


Figure 14. Mean proportion correct on the GERT-S for negative and positive/neutral emotions across Study 1 and Study 2, as a function of participant age group. Error bars denote one standard error around the mean and an asterisk signifies a significant difference between two means.

Discussion

The primary objective of the present study – and, moreover, of this entire thesis – was to investigate the effects of manipulating stereotype threat on older adults’ emotion recognition ability. The present study aimed to employ a more effective stereotype threat manipulation than was used in Study 1, based on the aging stereotypes that were endorsed by participants in Study 2. Young and older adults completed an emotion recognition task that was either framed as assessing cognitive ability, social ability, or general abilities. As hypothesised, the manipulation used in the current study produced a clear effect on older adults’ (but not younger adults’) feelings of stereotype threat. When emotion recognition was framed as a task that assesses cognitive ability – which is believed to decline with age – older participants reported heightened levels of stereotype threat. In comparison, their self-reported levels of threat were much lower in the control condition and the condition in

which emotion recognition was framed as assessing social ability, which is believed to be equivalent in young and older adults. Young participants' self-reported threat did not differ between experimental conditions. However, despite older adults' overt threat concerns being significantly heightened by the stereotype threat manipulation, their performance on the emotion recognition task was unaffected. The latter finding is inconsistent with multiple studies demonstrating that stereotype threat negatively affects older adults' performance on cognitive tasks, such as memory (Lamont et al., 2015). Rather, this finding indicates that emotion recognition may be one cognitive ability that is resilient against stereotype threat.

Another aim of the present study was to examine whether age group identification had any moderating or direct effect on young and older adults' emotion recognition ability. Unlike previous research showing that the degree of identification with stigmatised groups (such as race or gender groups) might moderate the effects of stereotype threat on stereotype-relevant tasks (Deaux et al., 2007; Marquet et al., 2019; Schmader, 2002), the present study's findings were more in line with those demonstrated by Kang and Chasteen (2009). Those authors found that older adults who identified strongly with their age group performed worse on a memory task than older adults who identified weakly, and that this effect was independent of stereotype threat condition. Similarly, although the stereotype threat manipulation used in the current study did not have any effect on young or older adults' emotion recognition, there was an effect of age group identification. Older adults who identified strongly with their age group performed worse on the GERT-S than those who identified weakly, regardless of stereotype threat condition. Conversely, young adults who identified strongly with their age group performed *better* than the weakly identified. Although Kang and Chasteen (2009) did not include young participants in their study, the

present study's findings in relation to older adults' emotion recognition closely parallel their findings about older adults' memory.

Kang and Chasteen (2009) provided two possible explanations for the results found in their study. Firstly, they suggested that older adults who are experiencing greater declines in memory may turn to other people their age for support, thus increasing their identification with their age group. With regard to the present study, it is highly feasible that those older adults experiencing greater cognitive decline (including the deterioration of emotion recognition ability) may also increase their identification with their age group. Indeed, increasing identification with a stigmatised group may lead to a sense of belonging that can buffer the negative effects of being part of a devalued group (Branscombe, Schmitt, & Harvey, 1999).

The second possible explanation for Kang and Chasteen's (2009) results was that older adults who identify strongly with their age group may be more likely to notice signs that they are expected to perform poorly on a task, thus creating some kind of stereotype threat effect even in low threat conditions (Kang & Chasteen, 2009). The current study's results are more consistent with the authors' first suggestion, however, for one main reason. The stereotype threat manipulation in Study 3 had no effect on emotion recognition ability, despite clearly leading to increased stereotype threat levels in the older participants. Hence, if a manipulation that is successful in producing feelings of stereotype threat does not affect emotion recognition, it seems unlikely that ambiguous cues would have any significant effect.

The finding that young adults who identified strongly with their age group were better at recognising emotions than those who identified weakly could be explained with reference to Tajfel's (2010) social identity theory. People are highly motivated to maintain a positive social identity through belonging to groups, and if belonging to a group does not

enhance their self-esteem, they are likely to leave that group (Brown, 2000; Martiny & Rubin, 2016). Perhaps young adults who do not feel that their cognitive functioning is up to the standard of their same-age peers distance themselves from the young adult age group to avoid experiencing a blow to their group-based self-esteem. Thus, those with worse cognitive functioning (and therefore, possibly worse emotion recognition ability) may be less strongly identified with being a young adult than those with better cognitive abilities.

Alternatively, young adults in the present study who are strongly identified with their age group might have been more sensitive to subtle cues that young and older age groups were being compared, even when age differences were not overtly mentioned (e.g., in the control condition). If this were the case, young adults who identified strongly with their age group may have been motivated to perform well on the GERT-S in order to maintain the ingroup advantage. This extra motivation may have helped young adults to perform slightly better than those young adults who were less strongly identified with their age group (and thus, potentially less motivated). This explanation would be in line with research suggesting that age comparisons can lead to improved performance within task domains in which an age group is competent (e.g., Swift et al., 2013).

Another finding (secondary to the current research focus) was that, contrary to Study 2, older adults were equally competent as young adults at recognising negative emotions and *better* at recognising positive emotions. At first glance, this finding appears to contradict the literature demonstrating age-related declines in emotion recognition. However, a comparison of GERT-S performance between participants from Study 2 and participants from Study 3 indicated that, while young adults' emotion recognition accuracy did not differ between studies, older adults were more accurate overall in Study 3 compared to Study 2. This enhanced accuracy of older participants in Study 3 could

potentially be driven by underlying differences in characteristics compared to the older participant sample in Study 2. Alternatively, some undetermined aspect of Study 3's methods could have improved older adults' overall performance on the GERT-S. Consequently, to control for potential confounding factors and inconsistencies across the two studies, to enhance power, and to gain a clearer picture of the age differences in emotion recognition, data from both studies were pooled.

The synthesis of GERT-S data from Study 2 and Study 3 revealed an overall effect whereby older adults were poorer than young adults when recognising negative emotions, but equally good at recognising positive emotions. This finding is consistent with previous research demonstrating age-related declines in recognising negative emotions such as fear, anger, and sadness (e.g., Ruffman et al., 2008). Furthermore, it is consistent with studies showing that older adults' recognition of dynamic expressions of positive emotions may, in fact, remain intact (Murphy, Lehrfeld, & Isaacowitz, 2010). For example, Murphy and colleagues (2010) found that, in one study, older adults did just as well as young adults at distinguishing between posed and spontaneous dynamic smiles, and in a second study, actually performed *better* than young adults. Their findings, along with the present study's findings, indicate that employing dynamic emotion stimuli may improve older adults' recognition of emotions – in particular, positive emotions (Ruffman, 2011). This idea is in line with the socioemotional selectivity theory and positivity effect (e.g., Carstensen, 2006), whereby older adults are more motivated to pay attention to positive information as opposed to negative information, and consequently may exhibit enhanced recognition of positive emotion. Thus, in future research investigating age differences in emotion recognition, it may be beneficial to use dynamic, multimodal tests of emotion recognition (such as the GERT-S), which, compared to tests comprised of still photographs of faces, may improve older adults' recognition of positive emotions.

To conclude, the results of Study 3 demonstrated a clear effect of stereotype threat on older adults' (but not young adults') self-reported threat concerns. Specifically, older adults felt more threatened when an emotion recognition task was framed as assessing cognitive ability (which is believed to decline with age), compared to when it was framed as assessing social or general abilities. However, this increased stereotype threat did not result in impairments in older adults' emotion recognition accuracy, suggesting that emotion recognition may be unaffected by feelings of stereotype threat. Potential reasons for why age-related stereotype may not affect older adults' emotion recognition ability are fully discussed in the following chapter (the General Discussion).

CHAPTER FIVE

General Discussion

The ability to accurately recognise emotions – particularly sadness, fear, and anger – from faces, bodies, and voices has consistently been shown to decline with age (Ruffman et al., 2008). However, it is possible that these age-related differences have been exaggerated or explained by a phenomenon known as stereotype threat. Being reminded of stereotypes about aging has a negative impact on older adults' performance on a wide range of cognitive tasks (Lamont et al., 2015). Barber (2017) suggested that, as opposed to anxiety or cognitive load, a lack of regulatory fit might explain the negative effect of age-related stereotype threat on older adults' cognitive performance. Specifically, stereotype threat might lead older adults to adopt a prevention focus (i.e., being more risk averse) when a promotion focus (i.e., approaching gains/successes) is more effective (Barber, 2017).

Analogous to memory, the recognition of emotions is arguably a cognitive task that declines with age and that likely benefits from a promotion focus (Sassenrath et al., 2014). Thus, stereotype threat might be expected to impair older adults' emotion recognition through a lack of regulatory fit. However, until this point in time, no research had been conducted into the possible effects of age-related stereotype threat emotion recognition. In response to this gap in the wide-ranging research on stereotype threat, three studies were conducted. The overarching hypothesis was that age-related stereotype threat would lead

older adults to experience feelings of threat, which, in turn, would further impair their ability to accurately recognise emotions expressed by others.

Effect of Stereotype Threat on Older Adults' Emotion Recognition

In the first study, a stereotype threat manipulation involved suggesting that either young or older adults are believed to be worse at recognising emotions. Contrary to expectations, stereotype threat did not affect young or older adults' recognition of emotions, or their identification of mental states. Furthermore, raising the stereotype that older adults are less accurate when recognising emotions did not lead participants aged over 65 years to experience increased self-reported stereotype threat, or increased state anxiety. On the other hand, adults aged 18-30 years were significantly threatened by the stereotype threat manipulation, and also experienced increased levels of anxiety. These findings raised the possibility that lay people do not actually believe that older adults are worse at recognising emotions, and may even believe that *young* adults are worse (hence the stereotype threat response in young adults).

The second study corroborated this hypothesis by demonstrating the existence of stereotypes that older adults are as good as, or better than, young adults at recognising emotions. Older adults were also expected to perform as well as young adults on social tasks, but less well on tasks within the cognitive domain. Further, there was some indication that age differences on the GERT-S were only evident among participants who reported viewing emotion recognition to be predominantly a cognitive ability, rather than a social ability. These data provided the foundation for the stereotype threat manipulation employed in the third study.

In Study 3, older adults' self-reported experience of stereotype threat differed according to the way that the emotion recognition task was framed. When the task was framed as assessing cognitive ability, which is widely believed to decline with age, older

adults were significantly more threatened compared to when the task was framed as assessing social or general abilities. The results demonstrated that, as hypothesised, the stereotype threat manipulation did not affect young adults' self-reported threat at all, whereas the manipulation was effective at producing feelings of stereotype threat in older adults. However, older adults' performance on the emotion recognition task was still not affected.

The finding that stereotype threat was effective in inducing feelings of threat in older adults is consistent with previous studies in which there were main or interaction effects of age-related stereotype threat (pertaining to cognitive or other stereotype-relevant tasks) on older adults' self-reported perceived threat (e.g., Barber et al., 2015; Gaillard et al., 2011; Kang & Chasteen, 2009). However, the finding that stereotype threat was ineffective at reducing older adults' emotion recognition ability is inconsistent with past studies. Previous research has consistently shown that age-related stereotype threat has robust, moderate-to-small negative effects on cognitive tasks in older adults (Armstrong et al., 2017; Lamont et al., 2015). Cognitive abilities that have been shown to be impaired by age-related stereotype threat include episodic and working memory (Armstrong et al., 2017), map learning (Meneghetti et al., 2015), and performance on predementia screening tests (Mazerolle et al., 2017).

Recently, Barber, Seliger, Yeh, and Tan (2018) – whose study was not yet published when the present research hypotheses were devised – investigated whether age-related stereotype threat affects older adults' memory for emotional information. As described in the introduction, socioemotional selectivity theory refers to how, in response to perceived limits on their lifespan, older adults tend to gravitate towards more positive aspects of life to effectively regulate their emotions (Carstensen, 1995, 2006). This leads to

a positivity effect, where older adults appear to attend more and have preferential memory for positive stimuli over negative stimuli (Barber et al., 2018; Mather & Carstensen, 2005).

Barber and colleagues (2018) wanted to discover whether older adults' positivity effect in memory is impaired by age-related stereotype threat concerning cognitive decline. In one of their experiments, young (aged 18-31 years) and older adults (aged 57-88 years) were assigned to one of two experimental conditions. In the stereotype threat condition, participants were reminded that older adults are usually not as competent as young adults on memory tests. In contrast, the stereotype alleviation condition involved informing participants that, although older adults are generally worse on memory tests, they always perform just as well as young adults on the specific picture test used in the present study. Participants then completed a memory test, which involved the presentation of positively- and negatively- valenced pictures and the subsequent free recall of these pictures.

Barber and colleagues (2018) found that young adults' memory for positive and negative pictures was not affected at all by stereotype threat condition, which is in line with the idea that stereotype threat should only affect individuals who are part of the targeted stigmatised group. On the other hand, it was demonstrated that age-related stereotype threat negatively affected older adults' memory for positive pictures, but not for negative pictures. These results from both of Barber and colleagues' (2018) experiments indicated that age-related stereotype threat has a negative effect on older adults' memory for emotional information.

Therefore, although the results of the present study suggest that age-related stereotype threat does not affect older adults' *recognition* of emotion, it may well affect their *memory* for emotions. Future research could involve further exploration and delineation of these findings by experimentally manipulating stereotype threat about age-related cognitive decline and measuring older adults' performance on a task that not only

measures the recognition of emotions, but also measures their ability to later recall the emotional faces. If age-related stereotype threat is shown to exclusively reduce older adults' memory for the facially-expressed emotions, but not their initial labelling of the emotions, this would provide further evidence that emotion recognition is unaffected by stereotype threat.

The current findings do not appear to support Barber's (2017) suggestion that a lack of regulatory fit underlies age-related stereotype threat. According to the regulatory fit hypothesis, stereotype threat might lead older adults to preferentially adopt a prevention focus (i.e., avoiding failures), which subsequently undermines their performance on cognitive tasks that require a promotion focus (i.e., approaching gains; Barber, 2017). If this were true, one might expect that emotion recognition, a cognitive task that benefits from a promotion focus (Sassenrath et al., 2014), would be disrupted by older adults' adoption of a prevention focus, caused by stereotype threat. Instead, the current studies' results demonstrated that emotion recognition was unaffected by feelings of stereotype threat. Thus, the findings fail to provide evidence in support of the regulatory fit hypothesis. However, given that regulatory focus was neither tested nor experimentally manipulated in the current research, it should not be ruled out as an underlying mechanism of age-related stereotype threat.

Interestingly, the current studies' results do appear to be consistent with the cognitive load hypothesis, which arguably underlies stereotype threat effects in younger adults (Barber, 2017; Schmader et al., 2008). According to this hypothesis, stereotype threat leads an individual to turn their focus towards the stereotype, thus increasing distracting thoughts and cognitive load (Schmader et al., 2008). In turn, an increased cognitive load reduces the amount of cognitive resources that can be applied to the stereotype-relevant task, subsequently impairing task performance (Schmader et al., 2008).

In line with this theory, it is possible that the recognition of emotions is more of an automatic process compared to other cognitive tasks (such as memory recall) and, therefore, requires fewer mental resources. This might make the recognition of emotions less susceptible to interference from cognitive load. In other words, the stereotype threat that older adults in Study 3 reported experiencing may have indeed increased their cognitive load but, due to the automaticity of emotion recognition, their accuracy on the emotion recognition task was unaffected.

Shiffrin and Schneider (1977) posited that controlled processing, which involves effortful, intentional, conscious processing of information, is easily affected by external or internal factors and is highly dependent on cognitive load. Conversely, automatic processing, which does not require deliberate effort, is less changeable and largely unaffected by load (Satpute & Lieberman, 2006). While memory does involve some automatic processing, such as encoding of sensory information, long-term memory often relies heavily on controlled processing, including the rehearsal of items or sequences and the search process employed during retrieval (i.e., searching through memory items; Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977). Therefore, because controlled processing is contingent on cognitive load, performance on tasks requiring effortful recall from long-term memory may be highly likely to be affected by stereotype threat, whereas more automatic processes may be somewhat resistant against stereotype threat (Mazerolle et al., 2012; Schmader et al., 2008).

Indeed, one study utilised a process-dissociation procedure (a method used to separate the contribution of automatic and controlled processes to performance on a task) to investigate the effects of stereotype threat on the automatic and controlled aspects of a memory recall task (Mazerolle et al., 2012). The authors found that age-related stereotype threat only impaired older adults' controlled use of memory, and actually intensified their

automatic recall. Another study led to a similar finding that stereotype threat negatively affected controlled retrieval but did not affect item encoding (Eich, Murayama, Castel, & Knowlton, 2014). Therefore, if stereotype threat only affects controlled processing, and if emotion recognition involves largely automatic processes, then it is entirely possible that emotion recognition is impervious to the potentially negative effects of stereotype threat.

However, the subject of whether emotion recognition is predominantly an automatic process continues to be debated by researchers (for a review, see Vuilleumier & Righart, 2011). Emotion recognition is typically assumed to involve rapid, automatic processing that often occurs outside of conscious awareness (Frith & Frith, 2007). Indeed, many studies have supported the idea that emotion recognition may be more automatic, fast, and involuntary, as opposed to controlled, deliberate, and intentional. Tracy and Robins (2008) found that adult participants were able to rapidly and accurately recognise basic emotions in faces even when cognitive load was increased (by instructing them to memorise a number prior to each block of photographs of faces). Furthermore, they compared participants' emotion recognition ability in a fast condition (where participants were encouraged to respond quickly based on their intuition) and a deliberated condition (where participants were told to "think carefully" about their responses and to take their time). Although participants' accuracy when recognising certain emotions was slightly higher when encouraged to deliberate, these differences were relatively small, and participants still had high accuracy scores in the fast condition. Therefore, although controlled processes such as deliberation might marginally improve emotion recognition accuracy, they do not appear to be necessary.

Another study investigated the automaticity of integrating facially-expressed emotions and contextual information (Aviezer, Bentin, Dudarev, & Hassin, 2011). To determine whether this face-context integration is an automatic, involuntary process or

more of a controlled, effortful process, Aviezer et al. (2011) attempted to ascertain the level of intentionality involved (i.e. whether the integration occurs reflexively) and the degree of effort involved (i.e. whether or not it requires a high level of cognitive resources). Over two experiments, the authors found evidence for the automatic nature of integrating emotional faces and context. Instructing participants to ignore the context in facial expressions of emotion was unsuccessful, suggesting that face-context integration occurs involuntarily and uncontrollably. Further, increasing cognitive load by making participants simultaneously memorise strings of letters and numbers had no effect on the integration of emotional faces and context.

To further examine the automaticity of integrating emotion and social information, Mumenthaler and Sander (2015) asked participants to identify dynamic facial expressions of fear, anger, or neutrality, expressed by target faces with forward-facing gaze. Concurrently, a contextual face (expressing either fear, anger, or neutrality) was presented in the periphery, which either gazed towards or away from the target face. Importantly, the contextual faces were rapidly masked before participants could become consciously aware of them. The results showed that participants were more accurate at recognising fear when an angry face in the periphery gazed at the target face, compared to when an angry face gazed away from the target face. This effect occurred despite the fact that the faces in the periphery did not reach participants' awareness. Thus, the integration of contextual social information and facial expressions of emotion may be relatively automatic and may occur early on in cognitive processing. Taken together, all of these results support the idea that the recognition of emotions – and the integration of emotions with the environment – largely involves automatic, reflexive, and effortless processes that require few mental resources and are less susceptible to negative effects from cognitive load.

However, other researchers have found that cognitive load *can* reduce performance on emotion recognition tasks. For example, one study showed that differences in emotion recognition ability between young and older adults were amplified when participants had to divide their attention between recognising emotions and a secondary task, which was taken as evidence that emotion recognition may involve controlled processes (Casares-Guillén, García-Rodríguez, Delgado, & Ellgring, 2016). Other researchers found evidence that the recognition of emotions in unfamiliar faces may involve a *combination* of automatic, bottom-up processes and controlled, top-down processes (Yan, Young, & Andrews, 2017).

In sum, researchers have not yet come to a consensus about the automaticity of emotion processing. However, the results of the present study are consistent with the idea that emotion recognition may be a largely automatic process. Young adults in Study 1 and older adults in Study 3 reported higher levels of stereotype threat when their age group was targeted by stereotypes. Many researchers have theorised that stereotype threat increases cognitive load, which often reduces individuals' performance on relevant tasks (Schmader et al., 2008). However, the current study's participants' ability to recognise emotions was unaffected by threat, suggesting that emotion recognition may be an automatic process that is impervious to the cognitive load caused by stereotype threat. Future research should continue to investigate the automaticity of emotion recognition.

Although the current findings are consistent with the hypothesis that cognitive load increases – rather than regulatory fit – may underlie stereotype threat effects on older adults' cognitive abilities, they do not provide direct evidence for this idea. Therefore, follow-up research could entail experimentally manipulating stereotype threat and regulatory focus (e.g., Barber et al., 2015) and measuring not only older adults' cognitive abilities, but also their experienced cognitive load. Psychophysiological indicators, such as

Heart Rate Variability, could possibly be used as a proxy for cognitive load (e.g., Croizet et al., 2004). Such a method might be beneficial for investigating whether regulatory focus and/or cognitive load moderate, mediate, or otherwise interact with age-related stereotype threat effects on cognitive tasks. Within this suggested study, the potential effect (or lack thereof) of stereotype threat on older adults' emotion recognition ability could be further tested, which would be valuable in determining the replicability of the current research findings.

A secondary aim of Study 1 involved examining whether age-related stereotype threat about emotion recognition had any effect on young or older adults' ability to identify more complex mental states (such as suspicious, playful, and nervous) from photos of eyes (on the RMET; Baron-Cohen et al., 2001). The results showed that, not only did RMET scores not differ between young and older participants (as discussed in Chapter 2), but stereotype threat condition did not affect either age groups' ability to identify mental states from eyes, despite young adults reporting heightened stereotype threat and state anxiety. One possible explanation for this finding is that young adults have usually been shown to perform well (and often better than older adults) on theory of mind tasks, including on the RMET (Henry et al., 2013). As Nguyen and Ryan's (2008) meta-analysis demonstrated, stereotype threat effects may be much smaller or non-existent when tasks are not challenging, which may explain why young adults' accuracy on the RMET was not impaired by their self-reported feelings of threat. Furthermore, like emotion recognition, theory of mind may be somewhat automatic (for a review, see Schneider, Slaughter, & Dux, 2017), and thus may be unaffected by cognitive load increases caused by stereotype threat. However, like the recognition of emotion, the automaticity of theory of mind continues to be debated among researchers (see Phillips et al., 2015).

Given that stereotype threat does not appear to explain differences in emotion recognition between young and older adults, it is likely that age-related declines in the recognition of emotion occur as a result of other processes, such as a decline in volume of certain cortical regions and/or neurotransmitters (Ruffman et al., 2008). This neuropsychological hypothesis is supported by studies showing that the age-related decline in the recognition of fear may be associated with a deterioration in grey matter (Williams et al., 2006) and that certain areas of the brain involved in emotion recognition (such as frontal and temporal regions) decline rapidly during older adulthood (Bartzokis et al., 2001; Fjell et al., 2009; Raz et al., 2005). Other hypotheses are more motivation-based, such as the idea that older adults might preferentially attend to positive stimuli over negative stimuli (i.e., the positivity effect; for a review, see Reed, Chan, & Mikels, 2014), possibly leading to preserved accuracy when recognising positive emotions but reduced accuracy when recognising negative emotions (Charles & Campos, 2011). As Charles and Campos (2011) highlighted, neuropsychological and motivational mechanisms (and, indeed, other contributing factors) might operate simultaneously or interact to produce age-related declines in emotion recognition. Therefore, possible interactions between underlying mechanisms should continue to be explored in future research.

Emotion Recognition as a Cognitive or a Social Task

The results from Study 2 showed that older adults are generally believed to be worse than young adults on cognitive tasks, but equally good at social interaction. Building on these findings, Study 3 demonstrated that framing emotion recognition as either assessing cognitive ability (believed to decline with age) or social ability (believed to remain preserved with age) influenced older adults' threat concerns. Although their emotion recognition ability was unaffected, older adults reported increased feelings of stereotype threat during the emotion recognition task when it was framed as assessing

cognitive ability. Comparatively, older adults' threat concerns were low when the task was framed as assessing social ability.

This apparent distinction between cognitive and social ability is interesting given that cognitive processing and everyday social interaction are inextricably linked. As Frith (2008) emphasised, cognition, which encompasses “the many different processes by which creatures understand and make sense of the world” (pp. 2033) is integral – and indeed, required – for social interactions. Further, Pessoa (2008) argued that there is no separation between affect and cognition in the brain; rather, they are highly integrated and should be conceptualised as such. This likely explains why deficits in cognition often have a detrimental effect on social functioning. For example, cognitive impairments (such as those resulting from a traumatic brain injury, dementia, or schizophrenia) often lead to significant deficits within the social domain (such as interpersonal relationships, social withdrawal, and community outcomes; Beard & Fox, 2008; Benedictus, Spikman, & van der Naalt, 2010; Liddle, 2000). Due to the close interplay between cognitive and social abilities, researchers commonly refer to *social cognition* when discussing processes that fall both within the cognitive and the social domain (such as emotion recognition; Frith, 2008).

However, in comparison to psychological researchers, lay people may have more distinct conceptualisations of cognitive and social abilities. Despite the interrelationship between cognitive processes and social behaviour, Study 2 indicated that people generally believe that cognitive functioning, but not social functioning, declines with age. This suggests that lay individuals may view cognitive and social abilities as relatively discrete constructs, perhaps partly due to the human desire to classify information into distinct categories (Brosch et al., 2010). Interestingly, however, Study 2's findings showed that emotion recognition may not fit neatly within the categories of either cognitive or social

ability, as relatively equal numbers of participants reported perceiving emotion recognition to be a cognitive or a social task. Thus, whereas processes such as memory and attention are usually categorised as cognitive functions (Frith, 2008; Pessoa, 2008), and skills such as empathy and relationship development are classified as social competencies (Allemand, Steiger, & Fend, 2015), emotion recognition might fit best somewhere in between (i.e. social cognition).

Given the present study's findings, the categorisation of sociocognitive tasks (such as emotion recognition) may be important. Study 3 showed that categorising emotion recognition as a cognitive task led older adults to feel concerned not only that their ability to perform well on the task would be affected by their age, but that the researcher would attribute their poor performance to their age. Therefore, although older adults' emotion recognition was not affected, they experienced doubts about their own abilities and concerns that the researcher would be prejudiced against them. Whether these feelings of threat had any flow-on effects outside of the experiment is unclear, although perceived threats may affect attitudes towards the outgroup (including increased intolerance of outgroup members; Skitka, Bauman, & Mullen, 2004), cause negative emotional responses (such as fear and resentment; Stephan, Ybarra, & Morrison, 2009) and undermine group esteem (i.e. perceptions of the ingroup's value, Riek, Mania, & Gaertner, 2006). Furthermore, feelings of stereotype threat in older adults may be related to decreased mental health, negative attitudes about stereotype-relevant domains, and disengagement from such domains (von Hippel et al., 2013; von Hippel, Kalokerinos, & Henry, 2015). As such, the current research findings highlight the importance of labelling tasks in a way that help older adults to feel comfortable and non-threatened while completing potentially difficult social cognitive tasks. Namely, it may be most beneficial to frame such tasks as assessing social, rather than cognitive, abilities.

The overlap and interrelation between cognitive and social abilities (and indeed, social cognitive abilities) give rise to another question: Do lay people fully understand what these terms mean? In Study 2, when participants were asked to consider whether a 25-year-old or a 75-year-old adult would be more competent at completing cognitive tasks, they were provided with examples (“e.g., involving attention, problem-solving, and decision-making”). However, these processes are only a few of many that fall under the umbrella term of cognition. Therefore, Study 2’s findings relied somewhat on the assumption that participants understand what “cognitive” (and “social”) means. This limitation may also extend to Study 3, in which emotion recognition was framed as a cognitive or social task. It was assumed that participants understood these terms, and indeed, the effect of the framing manipulation on older adults’ threat concerns would suggest that they did have some understanding. However, it may have been beneficial to provide further explanation as to what cognitive and social abilities are.

In addition, some other limitations present in the current research should be noted. In Study 1, which was conducted one-on-one with participants in a laboratory environment, two aspects of the methodology could have been problematic. Firstly, the researcher who conducted the first experiment was aged in her early twenties, meaning that her age alone could have subtly reminded older adults of their relative age and elicited thoughts about comparisons with younger adults. Secondly, older adults were recruited to Study 1 through a participant database comprising older people aged over 50 years, which may have increased the likelihood that older adults knew their age was a significant aspect of the research aims. Both of these factors could have had the potential to prompt stereotype threat-like effects in older adults and consequently affect their emotion recognition performance. In Study 3, these limitations were addressed by conducting the experiment via Mechanical Turk instead of face-to-face, and avoiding giving any

indication (prior to the stereotype threat manipulation) that young and older adults were being compared.

A limitation of both the first and the third studies is that, while age group identification was investigated as a potential moderator of stereotype threat, it was not possible to assess all other conceivable moderators of age-related stereotype threat on emotion recognition ability. It is possible that age-related stereotype threat did in fact affect the emotion recognition ability of certain older adults with particular dispositional features, but that effects were masked because these unknown personal characteristics were not measured. For instance, coping sense of humour (Ford et al., 2004), denial of stereotypes (Von Hippel et al., 2005), and defensive pessimism (Perry & Skitka, 2009) are some of the characteristics that have previously been shown to moderate effects of stereotype threat on stigmatised individuals. Consequently, future research should involve examining other moderators of stereotype threat and whether there *are* certain older individuals who are susceptible to negative effects of stereotype threat on emotion recognition ability.

Finally, the third study did not involve an assessment of participants' state anxiety, which has been previously shown to mediate the effects of stereotype threat on individuals' task performance in some cases (e.g., Lu et al., 2015; Tempel & Neuman, 2014). In Study 1, young participants not only experienced heightened stereotype threat, but also experienced increased anxiety in response to the stereotype threat manipulation (although this did not lead to any emotion recognition deficits). Measuring state anxiety in Study 3 would have helped to determine whether stereotype threat also caused older adults to experience increased anxiety alongside feelings of threat. Future studies should include state anxiety as a potential mediator of stereotype threat effects on older adults' cognitive abilities.

Implications of the Current Thesis

The present research provides some preliminary evidence that the recognition of emotions is one aspect of cognition that is resilient against stereotype threat. This finding has both negative and positive implications. With regard to negative implications, the present findings indicate that stereotype threat is not able to explain – either fully or partially – the differences that previous research have demonstrated between young and older adults' ability to recognise emotions. In other words, the consistent empirical finding that older adults perform worse than young adults when recognising certain emotions (Gonçalves, 2018; Ruffman et al., 2008) is unlikely to have been inflated (at least, by stereotype threat). Thus, the age-related deficits seen in emotion recognition ability are likely better explained by one or a combination of theories, such as the general cognitive decline associated with normal aging, changes in cortical regions involved in emotion recognition, and/or a positivity effect (Ruffman et al., 2008).

Given that stereotype threat cannot explain age-related differences in emotion recognition, any potential interventions to reduce age-related stereotype threat in the real world (such as removing reminders of negative aging stereotypes from a particular environment) would be unlikely to improve older adults' ability to recognise other people's emotions. Therefore, it is imperative that research continues to be conducted into the possible causes of age-related declines in emotion recognition, so that interventions may be designed to possibly prevent or lessen such declines. Despite the absence of a stereotype threat effect in the current research, the effects of negative aging stereotypes on other cognitive abilities have been well established (Lamont et al., 2015), and consequently, efforts should continue to be made to reduce ageism and prejudice against older adults. In spite of fears that ageism will never cease to exist (Butler, 1989, cited in Braithwaite, 2004), positive steps have been made towards reducing ageism, such as the

development and implementation of the Positive Education about Aging and Contact Experiences (PEACE) model (Levy, 2018). The model focuses on educating people about aging (including dispelling negative stereotypes of older adults) and encouraging positive intergenerational interactions. Lytle and Levy (2017) experimentally tested the application of the PEACE model, finding that, compared to a control condition, providing participants with factual information about aging and describing a positive relationship between a young adult and an older adult led to reduced negative attitudes towards older people. Thus, interventions using models such as PEACE may be promising.

There are also positive implications of the current research. Firstly, the findings indicate that older adults' knowledge of research aims and cues about age-related differences do not necessarily confound results in studies comparing older and younger adults' emotion recognition ability. Thus, researchers can use recruitment advertisements that openly request older adults' participation, or inform older adults that their emotion recognition abilities are being compared with young adults, without fear that stereotype threat will unfairly worsen older adults' emotion recognition ability. On the whole, the current studies' findings suggest that researchers can be relatively open with their participants about the aims of their research on age-related differences in emotion recognition ability. Nonetheless, in the interest of ensuring older adults feel comfortable during their completion of emotion recognition tasks, researchers may want to avoid using "cognitive" as a descriptor for emotion recognition, given that such a label led older adults in the present research to feel threatened.

Secondly, and perhaps most importantly, the findings suggest that older adults' capacity to recognise emotions expressed by their friends and family would be unlikely to be negatively affected by ageism, prejudice against older people, or aging stereotypes in their environment. In other words, even if older adults are exposed to subtle reminders of

negative aging stereotypes (such as a sign about dementia in a doctor's office, or a billboard advertising hearing checks for the elderly), this may not intensify any emotion recognition deficits nor have any further impact on their ability to effectively engage in social interaction. This is especially encouraging in light of research demonstrating negative consequences of social deficits in older adults, such as greater cognitive decline (Evans et al., 2018; Kelly et al., 2017; Seeman et al., 2001; Zunzunegui et al., 2003), heightened risk of early mortality (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015), and increased disability (Mendes de Leon, Glass, & Berkman, 2003).

In conclusion, the current research was the first to investigate whether older adults' recognition of emotions, a cognitive ability known to decline with age, is negatively affected by age-related stereotype threat. Three experiments provided evidence in support of the idea that emotion recognition may be one aspect of cognition that, unlike other cognitive abilities such as memory, is unaffected by stereotype threat. This might be because emotion recognition involves more reflexive, automatic processes as opposed to deliberate, controlled processes, making it less susceptible to cognitive load increases produced by stereotype threat. Consequently, the present study's findings provide some evidence for the cognitive load hypothesis of stereotype threat. Despite the absence of negative stereotype threat effects on older adults' emotion recognition, many other cognitive abilities *are* impaired by age-related stereotype threat. Consequently, interventions should be employed to ensure ageism and negative aging stereotypes are minimised.

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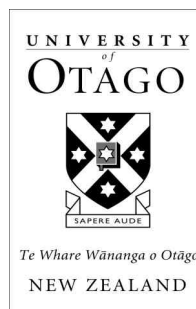
Appendix A

Information Sheets Provided to Participants in Study 1

Participants were given different information sheets depending on the condition to which they were assigned. Prior to requesting that participants read the information sheets themselves, the experimenter read the aim of the project aloud to participants to reinforce the manipulation.

1. Information sheet for 'older threat' condition.

Human Ethics Committee Reference Number: D15/403
17 December 2015



Investigating Emotion Recognition Ability in Young and Older Adults

INFORMATION SHEET FOR PARTICIPANTS

Thank you for showing an interest in this project. Please read this information sheet **carefully** before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part there will be no disadvantage to you of any kind and we thank you for considering our request.

What is the aim of the project?

It is widely believed that the ability to recognise emotions declines with age. Therefore, the purpose of this study is to see whether older people do perform more poorly on emotion recognition tasks than young people. Both older and younger people will be taking part in this research. This work is being undertaken as part of the requirements for Lianne Atkinson's PhD.

What types of participants are being sought?

We seek equal numbers of male and female undergraduate students (aged 18-30) recruited from the Psychology Participation Website or through psychology classes at the University of Otago, and people over 60 years of ages from a database of individuals who have volunteered to participate in research in the Psychology Department. Participants must be New Zealand residents, and have no experience of head injury or neurological impairment. In total, we seek 60 young adults, and 60 older adults, with approximately equivalent numbers of males and females.

Young adults recruited through Psychology classes: You will have the option of reporting on your experimental experiences for a small portion of class assessment. *Older adults and young adults recruited through Psychology Participation Website:* You will be reimbursed \$15 (young adults) to \$20 (older adults) for your out-of-pocket and travel expenses.

What does the study involve?

Participants will complete a range of pen-and-paper and computer tasks. First, participants will be asked to complete a vision test, followed by 2-3 questionnaires about mood and cognitive ability. Subsequently, participants will be asked to complete a computer task that involves recognising emotions from facial expressions presented on the computer screen. This will take one visit that will last up to 60 minutes.

What data or information will be collected and what use will be made of it?

Our aim is to explore emotion recognition ability with our interest in trends over large groups of individuals rather than single individuals. The data collected will be securely stored in such a way that only those directly involved in the project (i.e., the researchers) will have access to the data. The data will be stored on password-protected computers and data storage facilities. Data obtained as a result of the research will be retained for **at least 5 years** in secure storage. Any personal information held on the participants may be destroyed at the completion of the research even though the data derived from the research will, in most cases, be kept for much longer or possibly indefinitely.

Results of this project may be published, but any data included will be in no way linked to any specific participant; the data are collected and stored without any identifying information. You are most welcome to request a copy of the results of the project should you wish to.

Can participants change their mind and withdraw from the project?

You may withdraw from participation in the project at any time and without any disadvantage to yourself of any kind.

What if participants have any questions?

If you have any questions about our project, either now or in the future, please feel free to contact any of the following University of Otago Psychology Department staff members:

Lianne Atkinson (PhD candidate)

lianne.atkinson@otago.ac.nz

027 844 4277

Dr. Janice Murray

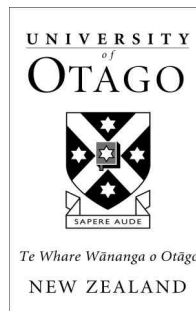
jmur@psy.otago.ac.nz

03 479-8353

This study has been approved by the Department stated above. However, if you have any concerns about the ethical conduct of the research you may contact the University of Otago Human Ethics Committee through the Human Ethics Committee Administrator (ph 03 479-8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

2. Information sheet for ‘young threat’ condition

Human Ethics Committee Reference Number: D15/403
17 December 2015



Investigating Emotion Recognition Ability in Young and Older Adults

INFORMATION SHEET FOR PARTICIPANTS

Thank you for showing an interest in this project. Please read this information sheet **carefully** before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part there will be no disadvantage to you of any kind and we thank you for considering our request.

What is the aim of the project?

It is widely believed that the ability to recognise emotions increases with age. Therefore, the purpose of this study is to see whether older people do perform better on emotion recognition tasks than young people. Both older and younger people will be taking part in this research. This work is being undertaken as part of the requirements for Lianne Atkinson's PhD.

What types of participants are being sought?

We seek equal numbers of male and female undergraduate students (aged 18-30) recruited from the Psychology Participation Website or through psychology classes at the University of Otago, and people over 60 years of ages from a database of individuals who have volunteered to participate in research in the Psychology Department. Participants must be New Zealand residents, and have no experience of head injury or neurological impairment. In total, we seek 60 young adults, and 60 older adults, with approximately equivalent numbers of males and females.

Young adults recruited through Psychology classes: You will have the option of reporting on your experimental experiences for a small portion of class assessment. *Older adults and young adults recruited through Psychology Participation Website:* You will be reimbursed \$15 (young adults) to \$20 (older adults) for your out-of-pocket and travel expenses.

What does the study involve?

Participants will complete a range of pen-and-paper and computer tasks. First, participants will be asked to complete a vision test, followed by 2-3 questionnaires about mood and cognitive ability. Subsequently, participants will be asked to complete a computer task that involves recognising emotions from facial expressions presented on the computer screen. This will take one visit that will last up to 60 minutes.

What data or information will be collected and what use will be made of it?

Our aim is to explore emotion recognition ability with our interest in trends over large groups of individuals rather than single individuals. The data collected will be securely stored in such a way that only those directly involved in the project (i.e., the researchers) will have access to the data. The data will be stored on password-protected computers and data storage facilities. Data obtained as a result of the research will be retained for **at least 5 years** in secure storage. Any personal information held on the participants may be destroyed at the completion of the research even though the data derived from the research will, in most cases, be kept for much longer or possibly indefinitely. Results of this project may be published, but any data included will be in no way linked to any specific participant; the data are collected and stored without any identifying information. You are most welcome to request a copy of the results of the project should you wish to.

Can participants change their mind and withdraw from the project?

You may withdraw from participation in the project at any time and without any disadvantage to yourself of any kind.

What if participants have any questions?

If you have any questions about our project, either now or in the future, please feel free to contact any of the following University of Otago Psychology Department staff members:

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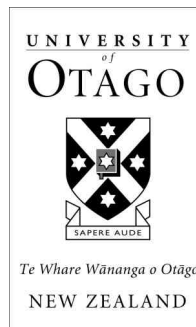
jmur@psy.otago.ac.nz

479-8353

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3. Information sheet for control condition

Human Ethics Committee Reference Number: D15/403
17 December 2015



Investigating Emotion Recognition Ability

INFORMATION SHEET FOR PARTICIPANTS

Thank you for showing an interest in this project. Please read this information sheet **carefully** before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part there will be no disadvantage to you of any kind and we thank you for considering our request.

What is the aim of the project?

The purpose of this study is to examine how we respond to emotional information in faces. Different types of people will be taking part in this research. This work is being undertaken as part of the requirements for Lianne Atkinson's PhD.

What types of participants are being sought?

We seek 120 adults drawn from the university population, recruited from the Psychology Participation Website, and a database of individuals who have volunteered to participate in research in the Psychology Department. Participants must be New Zealand residents, and have no experience of head injury or neurological impairment.

Participants recruited through Psychology classes: You will have the option of reporting on your experimental experiences for a small portion of class assessment. *Other participants:* You will be given monetary reimbursement for your out-of-pocket and travel expenses.

What does the study involve?

Participants will complete a range of pen-and-paper and computer tasks. First, participants will be asked to complete a vision test, followed by 2-3 questionnaires about mood and cognitive ability. Subsequently, participants will be asked to complete a computer task that involves recognising emotions from facial expressions presented on the computer screen. This will take one visit that will last up to 60 minutes.

What data or information will be collected and what use will be made of it?

Our aim is to explore emotion recognition ability with our interest in trends over large groups of individuals rather than single individuals. The data collected will be securely stored in such a way that only those directly involved in the project (i.e., the researchers) will have access to the data. The data will be stored on password-protected computers and data storage facilities. Data obtained as a result of the research will be retained for **at least 5 years** in secure storage. Any personal information held on the participants may be destroyed at the completion of the research even though the data derived from the research will, in most cases, be kept for much longer or possibly indefinitely.

Results of this project may be published, but any data included will be in no way linked to any specific participant; the data are collected and stored without any identifying information.

You are most welcome to request a copy of the results of the project should you wish to.

Can participants change their mind and withdraw from the project?

You may withdraw from participation in the project at any time and without any disadvantage to yourself of any kind.

What if participants have any questions?

If you have any questions about our project, either now or in the future, please feel free to contact any of the following University of Otago Psychology Department staff members:

Lianne Atkinson (PhD candidate)

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Dr. Janice Murray

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This study has been approved by the Department stated above. However, if you have any concerns about the ethical conduct of the research you may contact the University of Otago Human Ethics Committee through the Human Ethics Committee Administrator (ph 03 479-8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

Appendix B

Consent Form for Study 1

Following provision of the information sheets, participants were required to read the following consent form and sign it before proceeding.



Investigating Emotion Recognition Ability

CONSENT FORM

I have read the Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I have had the opportunity to discuss this study and I understand that I am free to request further information at any stage.

I know that:

1. My participation in the project is entirely voluntary;
2. I am free to withdraw from the project at any time without any disadvantage;
3. Personal identifying information, including questionnaires, will be destroyed at the conclusion of the project but any raw data on which the results of the project depend will be retained in secure storage for at least five years;
4. *Students from Psychology Classes:* Participants will have the option of reporting on their experimental experience for a small portion of class assessment. *Other participants:* Participants will be given compensation for travel and out-of-pocket expenses in the form of monetary compensation or petrol or book vouchers.
5. The results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand) but every attempt will be made to preserve my anonymity should I choose to remain anonymous.

I agree to take part in this project.

Full name (please print)

Signature of participant Date

Researchers: Lianne Atkinson (0278444277) and Dr Janice Murray (03 479 8353)

Project explained by

Project role

Signature: Date

Appendix C

Initial Demographics Questions Asked in Study 2

Participants answered the following demographic questions by either selecting one of multiple possible responses or by typing their answer in a blank field.

Demographics questions

In order to take part in this experiment, you must meet certain requirements. Please answer the following questions to check whether you are eligible. (Note: None of these answers will be shared with anybody else, and will be kept completely anonymous).

1. Which age group do you belong to?

- Under 18
- 18 – 30
- 30 – 40
- 40 – 49
- 50 – 64
- 65+

2. What is your date of birth? (dd/mm/yyyy)

3. What is your gender?

- Male
- Female
- Other

4. What is your ethnicity?

5. What is your highest level of education?

6. Are you proficient in the English language?

- Yes, English is my first language
- English is not my first language, but I am proficient/fluent in it
- No, I am not proficient in the English language

7. Are you currently on any medication? If yes, what medication?

- Yes _____
- No

8. Are you currently, or have you ever suffered from neurological problems (e.g., dementia, Alzheimer's, epilepsy, brain damage)? If yes, what problems have you experienced?

- Yes _____
 - No
-

Participants who, according to their responses to these questions, were eligible for the study were told, "You are eligible for this study. Please continue on to read the information sheet." Those who were ineligible were told, "You are not eligible for this particular study. Please make sure you do not submit the HIT through MTurk. Thank you for your time."

Appendix D

Information About Study 2 Presented to Participants

The following information was provided prior to Study 2 commencing.

Thank you for showing an interest in this project. Please read this information sheet **carefully** before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part, there will be no disadvantage to you of any kind and we thank you for considering our request.

What is the aim of the project?

The purpose of this study is to examine what people's beliefs are about aging, and also how we respond to emotional information in faces. This work is being undertaken as part of the requirements for Lianne Atkinson's PhD.

What types of participants are being sought?

We seek young and older adults for this research. Participants must be proficient English speakers and have no experience of head injury or neurological impairment. You will be reimbursed a small amount for your time and inconvenience.

What does the study involve?

Participants will complete a range of questionnaires about aging and competencies of different age groups, anxiety and depression, and demographic information. Subsequently, participants will be asked to complete a short computer task that involves recognising emotions from short video clips. On average, this will take around 20-30 minutes.

What data or information will be collected and what use will be made of it?

Our aim is to explore emotion recognition ability with our interest in trends over large groups of individuals rather than single individuals. The data collected will be securely stored in such a way that only those directly involved in the project (i.e., the researchers) will have access to the data. The data will be stored on password-protected computers and data storage facilities. Data obtained as a result of the research will be retained for **at least 5 years** in secure storage. Any personal information held on the participants may be destroyed at the completion of the research even though the data derived from the research will, in most cases, be kept for much longer or possibly indefinitely.

Results of this project may be published, but any data included will be in no way linked to any specific participant; the data are collected and stored without any identifying information. You are most welcome to request a copy of the results of the project should you wish to.

Can participants change their mind and withdraw from the project?

You may withdraw from participation in the project at any time and without any disadvantage to yourself of any kind.

What if participants have any questions?

If you have any questions about our project, either now or in the future, please feel free to contact any of the following University of Otago Psychology Department staff members:

Lianne Atkinson (PhD candidate)
lianne.atkinson@otago.ac.nz
+64-3-479-5489

Associate Professor Janice Murray
jmur@psy.otago.ac.nz
+64-3-479-8353

This study has been approved by the Department stated above. However, if you have any concerns about the ethical conduct of the research you may contact the University of Otago Human Ethics Committee through the Human Ethics Committee Administrator (ph +64-3-479-8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

Appendix E

Consent Form Presented to Participants in Study 2

After being presented with information about the study, the following information was provided to participants and consent was required before proceeding to the main survey.

Before beginning the survey, please read each of the following statements, and then indicate your consent if you understand and agree with them:

1. I have read the information sheet (above) concerning the project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.
2. My participation in the project is entirely voluntary.
3. I am free to withdraw from the project at any time without any disadvantage.
4. Personal information will be destroyed at the conclusion of the project, but any raw data on which the results of the project depend will be retained in secure storage for five years, after which they will be destroyed.
5. The results of the project may be published and will be available in the library but every attempt will be made to preserve my anonymity.

Please indicate your consent.

- I agree to take part in this project.

Appendix F

Questionnaire to Explore Age-Related Stereotypes in Study 2

The following questionnaire was based on the questions asked in Swift et al.'s (2013) study. The original questions asked in their study were retained, with further target items added. For each task domain, participants were asked to respond by selecting one of the following: Adults aged 25, No difference, or Adults aged 75.

Age-related stereotypes questionnaire

Please consider the following areas of competence. For each domain, please indicate the group that you think would be more competent: adults aged 25, adults aged 75, or both would perform equally well.

1. Solving crossword puzzles
 2. Being polite
 3. Driving
 4. Social interaction*
 5. Understanding others' viewpoints*
 6. Learning new skills
 7. Using the internet*
 8. Settling arguments
 9. Making financial decisions
 10. Recognising emotions in others' faces*
 11. Being creative
 12. Understanding how someone is feeling or what they are thinking*
 13. Reading for pleasure*
-

-
14. Completing cognitive tasks (e.g., involving attention, problem-solving, and decision-making)*
 15. Understanding others' emotional body language*
 16. Completing memory tasks*
 17. Imparting knowledge and wisdom*
 18. Completing computer tasks*
 19. Completing a running race*
 20. Looking after children
 21. Having a healthy diet
 22. Managing staff
 23. Taking directions from a supervisor
 24. Baking a cake*
 25. Recognising the emotion in others' tone of voice*

Note: Items added to Swift et al.'s (2013) questions by the author are indicated with an asterisk.

Appendix G

Table G-1.

Percentage of Participants Who Selected Either “Adults Aged 25”, “No Difference”, or “Adults Aged 75” as Most Competent in Various Domains, for Each Participant Age Group (Full Table)

Competency domain	Participant age group	Percentage of participants who selected “adults aged 25”, “no difference” or “adults aged 75”			Chi-square test of goodness of fit	
		Adults aged 25	No difference	Adults aged 75	X^2	p
Solving crossword puzzles	18-30	32.5	43.9	23.6	$X^2(2, N = 123) = 7.66$.022
	50-64	23.4	50.6	26.0	$X^2(2, N = 154) = 20.94$	< .001
	65+	28.7	55.2	16.1	$X^2(2, N = 143) = 34.29$	< .001
	Mean (all ages)	27.9	50.2	21.9	$X^2(2, N = 420) = 56.24$	< .001
Being Polite	18-30	18.7	56.1	25.2	$X^2(2, N = 123) = 29.46$	< .001
	50-64	1.9	39.6	58.4	$X^2(2, N = 154) = 76.46$	< .001
	65+	2.8	39.9	57.3	$X^2(2, N = 143) = 66.56$	< .001
	Mean (all ages)	7.1	44.5	48.3	$X^2(2, N = 420) = 130.56$	< .001
Driving	18-30	88.6	11.4	0	$X^2(2, N = 123) = 171.56$	< .001
	50-64	69.5	20.8	9.7	$X^2(2, N = 154) = 93.36$	< .001
	65+	66.4	25.9	7.7	$X^2(2, N = 143) = 77.59$	< .001
	Mean (all ages)	74	19.8	6.2	$X^2(2, N = 420) = 324.90$	< .001
Social Interaction	18-30	41.5	51.2	7.3	$X^2(2, N = 123) = 39.22$	< .001
	50-64	30.5	54.5	14.9	$X^2(2, N = 154) = 36.79$	< .001
	65+	18.2	67.1	14.7	$X^2(2, N = 143) = 73.78$	< .001
	Mean (all ages)	29.5	57.9	12.6	$X^2(2, N = 420) = 131.67$	< .001

Understanding others' viewpoints	18-30	43.1	35.0	22.0	$X^2(2, N = 123) = 8.39$.015
	50-64	14.3	38.3	47.4	$X^2(2, N = 154) = 27.05$	< .001
	65+	12.6	38.5	49.0	$X^2(2, N = 143) = 30.06$	< .001
	Mean (all ages)	22.1	37.4	40.5	$X^2(2, N = 420) = 24.27$	< .001
Learning new skills	18-30	88.6	9.8	1.6	$X^2(2, N = 123) = 170.39$	< .001
	50-64	79.9	19.5	0.6	$X^2(2, N = 154) = 158.27$	< .001
	65+	72.7	24.5	2.8	$X^2(2, N = 143) = 109.94$	< .001
	Mean (all ages)	80	18.3	1.7	$X^2(2, N = 420) = 429.10$	< .001
Using the internet	18-30	91.9	6.5	1.6	$X^2(2, N = 123) = 190.1$	< .001
	50-64	88.3	11.0	0.6	$X^2(2, N = 154) = 211.96$	< .001
	65+	71.3	27.3	1.4	$X^2(2, N = 143) = 107.26$	< .001
	Mean (all ages)	83.6	15.2	1.2	$X^2(2, N = 420) = 489.44$	< .001
Settling arguments	18-30	11.4	44.7	43.9	$X^2(2, N = 123) = 26.68$	< .001
	50-64	3.2	32.5	64.3	$X^2(2, N = 154) = 86.12$	< .001
	65+	2.1	39.2	58.7	$X^2(2, N = 143) = 71.01$	< .001
	Mean (all ages)	5.2	38.3	56.4	$X^2(2, N = 420) = 169.81$	< .001
Making financial decisions	18-30	4.9	37.4	57.7	$X^2(2, N = 123) = 52.44$	< .001
	50-64	4.5	24.7	70.8	$X^2(2, N = 154) = 106.53$	< .001
	65+	7.7	36.4	55.9	$X^2(2, N = 143) = 50.53$	< .001
	Mean (all ages)	5.7	32.4	61.9	$X^2(2, N = 420) = 199.09$	< .001
Recognising emotions in others' faces	18-30	10.6	56.1	33.3	$X^2(2, N = 123) = 38.24$	< .001
	50-64	5.2	45.5	49.4	$X^2(2, N = 154) = 55.22$	< .001
	65+	4.2	51.7	44.1	$X^2(2, N = 143) = 55.90$	< .001
	Mean (all ages)	6.4	50.7	42.9	$X^2(2, N = 420) = 140.70$	< .001
Being creative	18-30	47.2	52.0	0.8	$X^2(2, N = 123) = 58.98$	< .001

	50-64	32.5	64.3	3.2	$X^2(2, N = 154) = 86.12$	< .001
	65+	26.6	71.3	2.1	$X^2(2, N = 143) = 105.75$	< .001
	Mean (all ages)	34.8	63.1	2.1	$X^2(2, N = 420) = 234.44$	< .001
Understanding how someone is feeling/what they are thinking	18-30	17.1	59.3	23.6	$X^2(2, N = 123) = 38.24$	< .001
	50-64	3.2	42.2	54.5	$X^2(2, N = 154) = 66.25$	< .001
	65+	4.2	49.7	46.2	$X^2(2, N = 143) = 54.90$	< .001
	Mean (all ages)	7.6	49.8	42.6	$X^2(2, N = 420) = 128.19$	< .001
Reading for pleasure	18-30	6.5	44.7	48.8	$X^2(2, N = 123) = 40.15$	< .001
	50-64	3.2	45.5	51.3	$X^2(2, N = 154) = 63.52$	< .001
	65+	1.4	45.5	53.1	$X^2(2, N = 143) = 66.90$	< .001
	Mean (all ages)	3.6	45.2	51.2	$X^2(2, N = 420) = 169.64$	< .001
Completing cognitive tasks (e.g. involving attention, problem-solving, and decision-making)	18-30	69.1	28.5	2.4	$X^2(2, N = 123) = 83.32$	< .001
	50-64	56.5	37.7	5.8	$X^2(2, N = 154) = 60.56$	< .001
	65+	53.1	40.6	6.3	$X^2(2, N = 143) = 50.45$	< .001
	Mean (all ages)	59.0	36.0	5.0	$X^2(2, N = 420) = 185.33$	< .001
Understanding others' emotional body language	18-30	11.4	68.3	20.3	$X^2(2, N = 123) = 69.12$	< .001
	50-64	11.7	48.7	39.6	$X^2(2, N = 154) = 34.38$	< .001
	65+	4.2	47.6	48.3	$X^2(2, N = 143) = 54.64$	< .001
	Mean (all ages)	9.0	54.0	36.9	$X^2(2, N = 420) = 129.99$	< .001
Completing memory tasks	18-30	84.6	13.0	2.4	$X^2(2, N = 123) = 147.27$	< .001
	50-64	83.8	13.6	2.6	$X^2(2, N = 154) = 179.08$	< .001
	65+	77.6	19.6	2.8	$X^2(2, N = 143) = 132.27$	< .001
	Mean (all ages)	81.9	15.5	2.6	$X^2(2, N = 420) = 456.30$	< .001
	18-30	3.3	16.3	80.5	$X^2(2, N = 123) = 126.2$	< .001

Imparting knowledge and wisdom	50-64	3.9	7.8	88.3	$X^2(2, N = 154) = 209.82$	< .001
	65+	0.7	18.2	81.1	$X^2(2, N = 143) = 153.50$	< .001
	Mean (all ages)	2.6	13.8	83.6	$X^2(2, N = 420) = 484.900$	< .001
Completing computer tasks	18-30	90.2	7.3	2.4	$X^2(2, N = 123) = 179.71$	< .001
	50-64	82.5	17.5	0	$X^2(2, N = 154) = 174.62$	< .001
	65+	70.6	27.3	2.1	$X^2(2, N = 143) = 103.11$	< .001
	Mean (all ages)	80.7	17.9	1.4	$X^2(2, N = 420) = 441.30$	< .001
Completing a running race	18-30	91.1	8.1	0.8	$X^2(2, N = 123) = 185.42$	< .001
	50-64	95.5	4.5	0	$X^2(2, N = 154) = 268.18$	< .001
	65+	93.7	2.8	3.5	$X^2(2, N = 143) = 234.56$	< .001
	Mean (all ages)	93.6	5.0	1.4	$X^2(2, N = 420) = 686.61$	< .001
Looking after children	18-30	22.8	48.8	28.5	$X^2(2, N = 123) = 13.81$	< .001
	50-64	31.2	45.5	23.4	$X^2(2, N = 154) = 11.58$.003
	65+	31.5	48.3	20.3	$X^2(2, N = 143) = 17.01$	< .001
	Mean (all ages)	28.8	47.4	23.8	$X^2(2, N = 420) = 38.87$	< .001
Having a healthy diet	18-30	19.5	66.7	13.8	$X^2(2, N = 123) = 62.1$	< .001
	50-64	7.1	61.0	31.8	$X^2(2, N = 154) = 67.26$	< .001
	65+	5.6	65.0	29.4	$X^2(2, N = 143) = 76.80$	< .001
	Mean (all ages)	10.2	64.0	25.7	$X^2(2, N = 420) = 193.39$	< .001
Managing staff	18-30	26.8	56.1	17.1	$X^2(2, N = 123) = 30.44$	< .001
	50-64	16.9	47.4	35.7	$X^2(2, N = 154) = 21.91$	< .001
	65+	18.2	44.8	37.1	$X^2(2, N = 143) = 16.04$	< .001
	Mean (all ages)	20.2	49.0	30.7	$X^2(2, N = 420) = 53.59$	< .001
Taking directions	18-30	46.3	48.8	4.9	$X^2(2, N = 123) = 44.93$	< .001

from a supervisor	50-64	33.1	42.2	24.7	$X^2(2, N = 154) = 7.10$.029
	65+	23.8	55.9	20.3	$X^2(2, N = 143) = 33.16$	<.001
	Mean (all ages)	33.8	48.8	17.4	$X^2(2, N = 420) = 62.27$	<.001
	<hr/>					
Baking a cake	18-30	12.2	69.1	18.7	$X^2(2, N = 123) = 71.61$	<.001
	50-64	7.8	72.7	19.5	$X^2(2, N = 154) = 110.70$	<.001
	65+	2.8	69.9	27.3	$X^2(2, N = 143) = 99.04$	<.001
	Mean (all ages)	7.4	70.7	21.9	$X^2(2, N = 420) = 277.39$	<.001
<hr/>						
Recognising the emotion in others' tone of voice	18-30	9.8	69.1	21.1	$X^2(2, N = 123) = 73.22$	<.001
	50-64	2.6	55.2	42.2	$X^2(2, N = 154) = 69.36$	<.001
	65+	0	55.2	44.8	$X^2(2, N = 143) = 73.89$	<.001
	Mean (all ages)	3.8	59.3	36.9	$X^2(2, N = 420) = 196.30$	<.001

Notes. Percentages presented in bold are the highest within each participant age group

(significance level of $p < .05$). Where the second-highest percentage is statistically equivalent to the highest, that percentage is also bolded.

Appendix H

Initial Eligibility Questions Asked in Study 3

Participants answered the following two questions by selecting one of multiple possible responses.

Eligibility questions

In order to take part in this experiment, you must meet certain requirements. Please answer the following questions to check whether you are eligible. (Note: None of these answers will be shared with anybody else, and will be kept completely anonymous).

1. Which age group do you belong to?

- Under 18
- 18 – 30
- 30 – 49
- 50 – 64
- 65+

2. What is your gender?

- Male
 - Female
 - Other
-

Participants who were eligible for the study were informed, “You are eligible for this study. Please continue on to read the information sheet.” Those who were ineligible were told, “You are not eligible for this particular study. Please make sure you do not submit the HIT through MTurk. Thank you for your time.”

Appendix I

Stereotype Threat Manipulation Employed in Study 3

Participants were provided with differing descriptions of the aim of the study (displayed below), depending which condition they were assigned to (cognitive, social, or control).

1. Description of aim provided to participants in the ‘cognitive’ condition

Thank you for showing an interest in this project. Please read the information on this page and the next page **carefully** before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part there will be no disadvantage to you of any kind and we thank you for considering our request.

What is the aim of the project and what will be involved?

The purpose of this study is **to examine people’s cognitive ability at different ages**. Cognitive abilities help us to perform many different tasks involving perception, attention, problem-solving, and decision-making. In this study, **young adults’ (aged 18-30) and older adults’ (aged over 65)** performance on cognitive tasks will be compared.

In addition to these cognitive tasks, participants will answer some questions about demographic information, anxiety, and depression. On average, the survey will take around 20-30 minutes.

2. Description of aim provided to participants in the ‘social’ condition

Thank you for showing an interest in this project. Please read the information on this page and the next page **carefully** before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part there will be no disadvantage to you of any kind and we thank you for considering our request.

What is the aim of the project and what will be involved?

The purpose of this study is **to examine people’s social ability at different ages**. Social abilities help us to interact with friends, family, and strangers, and understand how other people are feeling. In this study, **young adults’ (aged 18-30) and older adults’ (aged over 65)** performance on social tasks will be compared.

In addition to these social tasks, participants will answer some questions about demographic information, anxiety, and depression. On average, the survey will take around 20-30 minutes.

3. Description of aim provided to participants in the control condition

Thank you for showing an interest in this project. Please read the information on this page and the next page **carefully** before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part there will be no disadvantage to you of any kind and we thank you for considering our request.

What is the aim of the project and what will be involved?

The purpose of this study is **to examine people's ability on various tasks**. Different types of people will be taking part in this research. The tasks include answering some demographic questions, a questionnaire about anxiety, stress, and depression, and defining the emotion being expressed by an actor in a video.

On average, the survey will take around 20-30 minutes.

Later, after participants signed the consent form, the stereotype threat manipulation was further reinforced by telling those in the 'cognitive' condition that "the following tasks will assess your **cognitive ability**", telling those in the 'social' condition that "the following tasks will assess your **social ability**", and telling those in the control condition that "the following tasks will assess your abilities in various domains."

Appendix J

Remainder of Study Description for Study 3

After participants were provided with descriptions of the study aims (depending on the condition to which they were assigned), all participants were provided with the following additional information.

What data or information will be collected and what use will be made of it?

The data collected will be securely stored in such a way that only those directly involved in the project (i.e., the researchers) will have access to the data. The data will be stored on password-protected computers and data storage facilities. Data obtained as a result of the research will be retained for **at least 5 years** in secure storage. Any personal information held on the participants may be destroyed at the completion of the research even though the data derived from the research will, in most cases, be kept for much longer or possibly indefinitely.

Results of this project may be published, but any data included will be in no way linked to any specific participant; the data are collected and stored without any identifying information. You are most welcome to request a copy of the results of the project should you wish to. This work is being undertaken as part of the requirements for Lianne Atkinson's PhD.

What if participants have any questions?

If you have any questions about our project, either now or in the future, please feel free to contact any of the following University of Otago Psychology Department staff members:

Lianne Atkinson (PhD candidate)

lianne.atkinson@otago.ac.nz

+64-3-479-5489

Associate Professor Janice Murray

jmur@psy.otago.ac.nz

+64-3-479-8353

This study has been approved by the Department stated above. However, if you have any concerns about the ethical conduct of the research you may contact the University of Otago Human Ethics Committee through the Human Ethics Committee Administrator (ph +64-3-479-8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

Appendix K

Consent Form for Study 3

The following consent form was provided to participants in Study 3. They were required to indicate their consent before continuing on to the rest of the survey.

Before beginning the survey, please read each of the following statements, and then indicate your consent if you understand and agree with them:

1. I have read the information concerning the project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.
2. My participation in the project is entirely voluntary.
3. I am free to withdraw from the project at any time without any disadvantage.
4. Personal information will be destroyed at the conclusion of the project, but any raw data on which the results of the project depend will be retained in secure storage for five years, after which they will be destroyed.
5. The results of the project may be published and will be available in the library but every attempt will be made to preserve my anonymity.

Please indicate your consent.

- I agree to take part in this project.

Appendix L

Demographics Questions Asked in Study 3

Participants answered the following demographic questions by either selecting one of multiple possible responses or by typing their answer in a blank field.

Demographics questions

Please answer the following demographic questions.

1. What is your age (in years)?

2. What is your ethnicity?

5. What is your highest level of education?

6. Are you proficient in the English language?

- Yes, English is my first language
- English is not my first language, but I am proficient/fluent in it
- No, I am not proficient in the English language

7. Are you currently on any medication? If yes, what medication?

- Yes _____
- No

8. Are you currently, or have you ever suffered from neurological problems (e.g., dementia, Alzheimer's, epilepsy, brain damage)? If yes, what problems have you experienced?

- Yes _____
 - No
-