

Age-Related Changes in Detecting Happiness: Discriminating Between Enjoyment and Nonenjoyment Smiles

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The present study investigated age-related changes in the ability to discriminate between distinctions in the emotion underlying enjoyment and nonenjoyment smiles, both when making explicit decisions about feelings of happiness and when making social judgments of approachability. No age differences were found in the ability to discriminate between these two types of smile. However, older adults demonstrated a greater bias toward reporting that any smiling individual was feeling happy. Older adults were also more likely to choose to approach an individual who was displaying a nonenjoyment smile. Implications of these findings for older adults' interpersonal functioning are discussed.

Keywords: smiles, aging, positivity bias, emotion

Many studies report evidence of age-related impairments in emotion recognition, predominantly when recognizing facial expressions of anger, fear, and sadness. Compared with the findings for negative emotions, age-related declines in happiness perception are rarely significant and are of substantially smaller effect size (see Issacowitz et al., 2007; Ruffman, Henry, Livingstone, & Phillips, 2008, for reviews). Relatively spared perception of positive compared with negative expressions may be linked to more general biases in processing positive information in old age (Williams et al., 2006). According to the socioemotional selectivity theory (SST; Carstensen, Fung, & Charles, 2003), when time is perceived to be limited, as in older age, individuals focus on optimizing positive emotions and avoiding negative interactions. This may link to an age-related improvement in emotion regulation, with older adults exhibiting a positivity bias both when attending to and recalling emotional material (Leighland, Schulz, & Janowsky, 2004; Mather & Carstensen, 2003).

In studies investigating age differences in the ability to recognize positive facial expressions (i.e., smiles), researchers have asked participants to decide which of six basic emotions (anger, fear, sadness, disgust, surprise, or happiness) a smiling individual is portraying. In studies with this task, at least one of the age groups shows ceiling effects (Issacowitz et al., 2007), thereby limiting the potential to detect age-related differences in happiness perception. It is thus important to use measures that provide more sensitive indices of the recognition of positive emotion to investigate age differences in the perception of happiness. We address this issue in the present research by using stimuli that portray subtle but socially meaningful differences in smile physiognomy.

These differences pertain to the underlying emotional experience of an individual, detection of which has been argued to be critical to effective social interaction (Johnston, Miles, & Macrae, in press; Miles, 2009; Miles & Johnston, 2007; Owren & Bachorowski, 2001). This approach provides a means to assess sensitivity to functional distinctions in emotional meaning between positive expressions rather than treating all smiles as a single generic expression.

It has been argued that morphological distinctions can be made between smiles related to an underlying experience of positive emotion (i.e., enjoyment smiles) and smile-like social signals unrelated to internal emotional states (i.e., nonenjoyment smiles) by examining the muscles involved in their production (e.g., Ekman, 2001; Frank, 2002; Frank, Ekman, & Friesen, 1993). The contraction of the zygomatic major muscles lifts the corners of the mouth obliquely upward into the typical smile shape. However unlike nonenjoyment smiles, enjoyment smiles also involve the contraction of the orbicularis oculi muscles, which produce changes to the eye region (Ekman, Davidson, & Friesen, 1990), including narrowed eyes, wrinkles around the outer corners, and lowered eyebrows (see Frank, 2002, for an overview). These differences provide a reliable source by which perceivers can detect the emotional state of a smiling individual.

Younger adults are sensitive to differences in emotional meaning between deliberately posed nonenjoyment smiles and spontaneously expressed enjoyment smiles, categorizing more of the latter as reflecting genuine feelings of happiness when judging static images, video displays, and real-life interactions (Frank, Ekman, & Friesen, 1993; Miles & Johnston, 2007; Scherer & Ceschi, 2000). Younger participants also differentiate between enjoyment and nonenjoyment smiles when making more implicit judgments (Frank et al., 1993; Mehu, Little, & Dunbar, 2007; Peace, Miles, & Johnston, 2006). Because these smiles have very different social meanings, the ability to distinguish between them is important for effective interpersonal functioning (Ekman, 2001). Boraston, Corden, Miles, Skuse, and Blakemore (2008) found that autistic individuals who had the most difficulty differentiating between smiles also had the greatest impairments in social inter-

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action. Hence, sensitivity in discriminating between these types of smiles may have wider social consequences. To date, this ability has not been investigated in relation to aging. We present two studies examining age differences in the ability to perceive distinctions in the emotional states and social meaning underlying smiles.

Study 1

In Study 1, we investigated age differences in the ability to detect the underlying emotional state of others by explicitly discriminating between enjoyment and nonenjoyment smiles. Younger and older adults were presented with photographs of individuals displaying enjoyment smiles, nonenjoyment smiles, or neutral expressions. Participants were asked to directly identify the underlying emotional state of the individual (i.e., is the person feeling happy?) rather than to make a conceptual distinction of smile veracity (e.g., fake vs. genuine) because the main aim of the present research was to assess the ability to recognize positive affect. This task may reveal age differences in happiness perception because it requires sensitivity to subtle differences in the emotional meanings of smiles rather than simply discriminating smiles from other facial expressions (e.g., anger, fear, and sadness). In addition, according to the SST, there is an age-related positivity effect when processing emotional stimuli. It has previously been argued that positivity effects in older adults may underlie age-related declines in the recognition of negative but not positive emotional expressions (Williams et al., 2006). Positivity effects may influence older adults' detection of positive emotion such that older adults may have a greater bias toward thinking that all smiling individuals are experiencing happiness.

Methods

Participants. Two groups of participants were recruited: 39 young adults (31 women, 8 men) ages 17 to 36 ($M = 21.3$, $SD = 4.2$) and 35 older adults (25 women, 10 men) ages 65 to 81 ($M = 74.0$, $SD = 5.1$). All were fluent in English and free from past or present neuropsychological disorders. Older adults had significantly fewer years of education than younger participants, $t(72) = 2.8$, $p < .01$ (for young adults, $M = 14.9$, $SD = 2.7$; for older adults, $M = 13.0$, $SD = 3.2$). All older adults achieved a score greater than 24, the cutoff point recommended by Chayer (2002) on the Mini Mental State Examination (Folstein, Folstein, & McHugh, 1975).

Stimuli and procedure. Photographs of 13 young individuals (3 male and 10 female individuals) were used. There were three photographs of each individual: a neutral expression, a deliberately posed nonenjoyment smile (which showed evidence of zygomatic major but not orbicularis oculi activity and was produced volitionally by individuals reporting a neutral mood), and a spontaneous enjoyment smile (which showed evidence of both zygomatic major and orbicularis oculi activity and was displayed spontaneously after a positive mood induction procedure). For more detailed information on how these stimuli were created and for exemplars, see Miles and Johnston (2007).

Faces were presented individually in the center of a computer screen in a random order. For each trial, participants were asked to decide whether the person photographed was feeling happy or not feeling happy. It was emphasized that they should not just consider the expression the person was portraying but also the underlying emotional state of the person (i.e., they were asked to think about how the person was actually feeling; see Miles & Johnston, 2007). Four practice trials preceded the experiment.

Results and Discussion

We conducted a mixed-model analysis of variance (ANOVA) with expression (neutral, nonenjoyment, enjoyment) as the within-subjects variable and age group as the between-subjects variable to compare the frequency with which participants categorized the faces as feeling happy (see Table 1). This revealed a main effect of expression, $F(2, 144) = 745.57$, $p < .001$, $\eta_p^2 = .91$. Planned comparisons revealed that enjoyment smiles were more frequently categorized as happy than either nonenjoyment smiles ($p < .001$) or neutral expressions ($p < .001$) and that nonenjoyment smiles were also more frequently categorized as happy than neutral expressions ($p < .001$). The age groups also differed, $F(1, 72) = 9.56$, $p < .01$, $\eta_p^2 = .12$, with older adults being more likely to categorize expressions as happy. These effects were qualified by an Expression \times Age Group interaction, $F(2, 144) = 10.36$, $p < .01$, $\eta_p^2 = .13$. Planned comparisons revealed that older adults responded that smiles were happy more often than younger adults for both enjoyment ($p < .001$) and nonenjoyment ($p < .001$) smiles. No age difference was found for the neutral expressions ($p = .38$).

Together, these findings suggest that older adults had a greater propensity to identify an individual as feeling happy regardless of smile type. To investigate this further, we conducted a nonparametric signal detection analysis. Hit and false alarm rates were

Table 1
Mean Percentages and Standard Deviations for the Number of Times Younger and Older Adults Categorized Individuals Displaying Enjoyment, Nonenjoyment, and Neutral Expressions as Feeling Happy and a Summary of Independent Samples *t* Tests Comparing the Means of Younger and Older Adults

Expression	Younger		Older		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Enjoyment smiles	87.38	9.74	95.60	7.53	4.03	<.001	0.94
Nonenjoyment smiles	59.71	21.77	76.26	19.06	3.58	<.001	0.81
Neutral expressions	9.86	13.78	6.81	13.29	-0.97	.34	0.23

calculated for each condition (hits were defined as correctly categorizing an enjoyment smile as happy; false alarms were defined as identifying a nonenjoyment smile as happy) and were used to calculate estimates of sensitivity to discriminate between smile types (A') and response bias (B'') for each age group. One-sample t tests comparing mean sensitivity for each age group (young $A' = .73$, $SD = .14$; older $A' = .72$, $SD = .15$) to chance ($A' = .50$) revealed that both younger, $t(38) = 10.25$, $p < .01$, $d = 1.64$, and older adults, $t(34) = 9.06$, $p < .01$, $d = 1.47$, were able to reliably differentiate between enjoyment and nonenjoyment smiles. There was no age difference in sensitivity, $t(72) = .22$, $p = .83$. Mean levels of response bias (young $B'' = -.76$, $SD = .28$; older $B'' = -.92$, $SD = .19$) were then compared with 0 (i.e., no bias). Both younger, $t(38) = 16.70$, $p < .001$, $d = 2.71$, and older adults, $t(34) = 28.09$, $p < .001$, $d = 4.84$, were more likely to select the *happy* than the *not happy* label. However, older adults demonstrated a significantly greater bias than younger adults, $t(72) = 2.79$, $p < .01$, $d = 1.08$.

Younger adults were sensitive to differences between enjoyment and nonenjoyment smiles, consistent with previous research (Frank et al., 1993; Miles & Johnston, 2007). Older adults were found to be as sensitive as younger adults when discriminating between these two types of smile, indicating that there were age-related similarities in the perception of happiness. However, the current findings also revealed age differences in the interpretation of subtle but meaningful differences in positive facial expressions; older adults had a greater tendency (i.e., response bias) to categorize the target as feeling happy regardless of the type of smile displayed.

Age-related changes may have been influenced by differences in the interpretation of the instructions, but the overall response pattern of older adults makes this unlikely. If older adults simply misunderstood the instructions, thinking that they were required to indicate when someone was *displaying* a happy facial expression, they would not have shown sensitivity to the differences between enjoyment and nonenjoyment smiles (i.e., they would likely have said that every smiling individual was happy). Another possibility is that older adults misinterpreted the label *not happy* as meaning unhappy. However, if this were the case, then it would also seem logical that older adults would have categorized those displaying neutral expressions as happy because they also did not look unhappy. In fact, older adults rarely categorized individuals with neutral expressions as happy. This finding also suggests that the bias found in this study was not due to older adults immediately responding that an individual was happy without fully examining the images. It therefore seems plausible that these results may reflect an age-related positivity bias toward thinking that those who are smiling are feeling happy even when their smiles do not involve facial information that specifies underlying feelings of happiness. This suggestion supports the SST, which proposes that older adults tend to enhance positive emotional experience, resulting in a bias toward positive interpretation of information (Carstensen et al., 2003). In summary, the present study revealed age-related similarities in the ability to discriminate between enjoyment and nonenjoyment smiles but also a difference in that older adults had a greater bias toward thinking that any smiling individual was feeling happy.

Study 2

By using a more subtle measure of happiness perception, Study 1 revealed that older adults were more likely than younger adults to attribute underlying feelings of happiness to both enjoyment and nonenjoyment smiles. However, in everyday social interactions, individuals do not explicitly and consciously make decisions about how to label a facial expression. The second study addresses whether there are age differences in social judgments about enjoyment and nonenjoyment smiles when the emotional expression of the target individual is not referred to explicitly. Participants made forced-choice decisions about their likelihood of asking someone for a favor when that individual was displaying different facial expressions (i.e., enjoyment smiles, nonenjoyment smiles, and neutral expressions). Previous research has found that younger adults' social responses to individuals vary depending on the type of smile that they are portraying. Compared with nonenjoyment smiles, enjoyment smiles have been rated more highly on positive personality traits, such as sociability, pleasantness, and generosity (Frank et al., 1993; Mehu et al., 2007). Younger adults are also more likely to approach individuals displaying enjoyment smiles compared with nonenjoyment smiles (Miles, 2009). Therefore, it could be argued that socially skilled individuals should be more likely to ask a favor from someone displaying an enjoyment smile, because this should increase the chance of reciprocal social contact and cooperation (Owren & Bachorowski, 2001).

Methods

Participants. The younger and older participants recruited for Study 1 also took part in Study 2.

Stimuli and procedure. We created face pairs with the stimuli from Study 1. Three face pairs were created for each of the individuals displaying the expressions. Within each face pair, both images were of the same identity but displayed different expressions. In one pair, a nonenjoyment smile was coupled with an enjoyment smile. In the other two face pairs, the images of neutral expressions were paired with either enjoyment smiles or nonenjoyment smiles, respectively.

Thirty-nine face pairs (13 in each condition) were randomly presented to participants. Each pair of faces was presented side by side on a computer screen, and location (i.e., left or right) of the expressions was counterbalanced. Participants were told that in each trial they would see two photographs of the same person on the screen but that the photographs had been taken at different times (e.g., the one on the left was taken on Monday at 10 a.m., and the one on the right was taken on Tuesday at 10 a.m.). Participants were instructed to indicate, with a keypress, which time they would rather ask that person for a favor. Participants received four practice trials.

Results and Discussion

The mean frequency with which younger and older adults chose to ask a favor when the targets were displaying an enjoyment smile compared with a nonenjoyment smile and when the targets were displaying both types of smile compared with neutral expressions can be seen in Table 2. One-sample t tests revealed that both age groups were more likely than chance to choose the individual displaying an enjoyment smile when coupled with images of nonenjoyment smiles

Table 2

*Mean Percentages and Standard Deviations for the Number of Times Younger and Older Adults Chose to Ask an Individual for a Favor When They Were Displaying an Enjoyment Smile (vs. Nonenjoyment Smile and Neutral Expression) and a Nonenjoyment Smile (vs. Neutral Expression) and a Summary of Independent Samples *t* Tests Comparing the Means of Younger and Older Adults*

Expression	Younger		Older		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Enjoyment vs. nonenjoyment	79.29	15.70	66.37	23.68	2.79	<.01	0.64
Enjoyment vs. neutral	95.07	8.37	92.53	13.26	1.00	.32	0.23
Nonenjoyment vs. neutral	94.87	8.34	90.99	13.26	1.52	.13	0.35

Note. All means are significantly different from chance (50%).

or neutral expressions. Both groups were also more likely than chance to choose the smiling individual in the nonenjoyment versus the neutral condition. To examine for age differences in these responses, independent-sample *t* tests were carried out for each condition (see Table 2). The critical condition was the one in which participants had to choose between enjoyment and nonenjoyment smiles in terms of approach judgments. Here, there was a significant age difference, with younger adults more likely than older adults to choose the enjoyment smile. For the other two conditions (smiles vs. neutral), no age differences were found.

Therefore, there were no age differences in the tendency to ask an individual for a favor when they were smiling compared with when they were displaying a neutral expression, indicating that older and younger adults were equally responsive to smiles when paired with neutral faces. However, age-related differences were found in the critical condition that required participants to discriminate between enjoyment and nonenjoyment smiles. Younger adults were most likely to ask another individual for a favor when that person was displaying an enjoyment smile rather than a nonenjoyment smile, in line with previous results indicating that younger adults find those with enjoyment smiles more approachable, generous, and sociable (Frank et al., 1993; Johnston et al., in press; Mehu et al., 2007; Miles, 2009). Older adults were also more likely than chance to choose to ask an individual for a favor when they were displaying an enjoyment (vs. nonenjoyment) smile. However, of importance, older adults differentiated between these smiles to a lesser extent than younger adults. These results suggest that older adults may be less able to detect the social meanings behind different types of smile and thus are less likely to make judgments on the basis of the distinct social affordances that only enjoyment smiles offer (e.g., increased cooperation, approachability, generosity, and reciprocation of social contact).

General Discussion

Using a more sensitive measure than has been used in previous research, we found both similarities and subtle age differences in interpreting positive facial expressions. No age differences were found in the ability to discriminate between enjoyment and nonenjoyment smiles. However, older adults had a greater bias toward thinking that individuals were feeling happy when they were displaying either enjoyment or nonenjoyment smiles (Study 1). In addition, when not explicitly instructed to attend to the facial expression of the individual, older adults were less likely than the younger group to approach someone displaying an enjoyment (vs.

a nonenjoyment) smile (Study 2). Consistent with SST, these findings may reflect an age-related positivity bias when processing positive emotional faces. However, we did not administer a measure (e.g., assessing future time perspectives) to support SST as a mechanism underlying age differences in this study, so this needs more definitive support through further studies.

There are a number of alternative explanations for the present findings. These tasks involved discriminating between subtle differences in facial expression; thus, age-related declines in visual perception may contribute to performance differences. In the present study, age-related declines were found in visual contrast sensitivity (Pelli Robson Contrast Sensitivity Test; Pelli, Robson, & Wilkins, 1988), but this was not related to the ability to discriminate between enjoyment and nonenjoyment smiles in either study. Another possible explanation may relate to visual scanning of faces. Older adults have been found to make fewer fixations to the eye regions of emotional faces than younger adults (Sullivan, Ruffman, & Hutton, 2007; Wong, Cronin-Golomb, & Nearing, 2005). Distinguishing between smile types requires attention to the eye region of the face (Boraston et al., 2008), meaning that differences in scan patterns may have influenced performance. Differences in personality characteristics could also contribute to age-related changes in the detection of another person's underlying positive emotional state (e.g., openness to experience involves receptiveness to inner emotional states; Costa & McCrae, 1992).

Although not addressed in the present research, these results may have implications for younger and older adults' social functioning. Misidentifying an enjoyment smile as a nonenjoyment smile could result in younger adults missing out on high-quality social interactions with others. Alternatively, mistaking a nonenjoyment smile for an expression of happiness may impact older adults' social behavior (e.g., asking a favor or continuing conversations with those who wish to offer only a polite greeting smile) and could result in unreciprocated attempts at social contact. Studies have found an age-related increase in some socially inappropriate behaviors (e.g., making socially inappropriate comments and engaging in extended speech; Henry, von Hippel, & Baynes, 2009). Where behaviors seem inappropriate and are unreciprocated, this may result in decreases in social engagement, with older adults becoming less likely to try to forge new social relationships (see Carstensen et al., 2003, for a review).

Previous research has suggested that individuals can also use smiles to mask an intention or emotion (i.e., to attempt to deceive the perceiver; Ekman, Friesen, & O'Sullivan, 1988). Approaching

individuals who are displaying deceptive smiles could have particularly serious social implications. Given previous findings of age-related changes in deception detection (Stanley & Blanchard-Fields, 2008) and suggestions that older adults are most at risk of becoming victims of fraud (Mackin, 1994), this is an important issue for further investigation. Researchers should develop stimuli in which individuals are asked to deceive another person by pretending they are happy (see Ekman et al., 1988), that is, to depict masking smiles. These could then be used to examine age differences in the ability to detect deceptive smiles.

One limitation of the present study is that all photographs used were of younger adults. This could have had particular consequences for judgments of social approach because older adults are more likely to interact with others of the same age (Ebner & Johnson, 2009); thus, because of increased familiarity with social partners their own age, older participants may have found it easier to differentiate between different types of smiles when displayed by others of their own age. Stimuli depicting older adults displaying enjoyment and nonenjoyment smiles should be developed and administered to resolve this issue. In addition, because of the limited number of smiling faces available as stimuli in the current study, the same identities were used to display each expression type. Therefore, it would be useful to increase the number of stimuli used in future studies.

In summary, although there was no age difference in the ability to discriminate spontaneous enjoyment smiles from deliberate nonenjoyment smiles, older adults had a greater bias toward thinking that any smiling individual was feeling happy. They were also more likely than younger participants to ask an individual for a favor when that person was displaying a nonenjoyment smile. Questions remain regarding the mechanisms underlying these age-related differences and the extent to which these changes impact older and younger adults' social functioning.

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