Neural and behavioral bases of age differences in perceptions of trust

Elizabeth Castle[a], Naomi I. Eisenberger[a], Teresa E. Seeman[b], Wesley G. Moons[a], Ian A. Boggero[a], Mark S. Grinblatt[c], and Shelley E. Taylor[a,1]

[a]Department of Psychology and [b]Division of Geriatrics, David Geffen School of Medicine, University of California, Los Angeles, CA 90095; and [c]Anderson School of Management, University of California, Los Angeles, CA 90024

Contributed by Shelley E. Taylor, October 24, 2012 (sent for review August 29, 2012)

Older adults are disproportionately vulnerable to fraud, and federal agencies have speculated that excessive trust explains their greater vulnerability. Two studies, one behavioral and one using neuroimaging methodology, identified age differences in trust and their neural underpinnings. Older and younger adults rated faces high in trust cues similarly, but older adults perceived faces with cues to untrustworthiness to be significantly more trustworthy and approachable than younger adults. This age-related pattern was mirrored in neural activation to cues of trustworthiness. Whereas younger adults showed greater anterior insula activation to untrustworthy versus trustworthy faces, older adults showed muted activation of the anterior insula to untrustworthy faces. The insula has been shown to support interoceptive awareness that forms the basis of "gut feelings," which represent expected risk and predict risk-avoidant behavior. Thus, a diminished "gut" response to cues of untrustworthiness may partially underlie older adults' vulnerability to fraud.

aging | emotions | limbic system | socioemotional selectivity

Older adults are disproportionately vulnerable to frauds of many kinds. Both the Federal Bureau of Investigation (1) and the Federal Trade Commission (2) have conjectured that older adults' excessive positive responses to other people may underlie their vulnerability. Consistent with this idea, a large body of literature indicates that older adults shape their experiences and social networks in ways that lead to positive socioemotional outcomes (3). As such, older adults' judgments of the trustworthiness of others may also be skewed in a positive direction. Affective judgments of trustworthiness implicate processing in limbic regions, including the amygdala and insula (4, 5). Accordingly, age differences in trust may be reflected in altered patterns of activation in these neural regions.

We report the results of two investigations that address how older adults process facial cues indicative of trust differently from younger adults. The first is a behavioral study in which participants rated faces that varied in cues conveying trustworthiness (trustworthy, neutral, untrustworthy) (4). The second study used functional neuroimaging to identify whether facial cues of trustworthiness are processed differently in the brains of older vs. younger adults. We predicted that older adults would perceive people to be more trustworthy and that this pattern would be reflected in lesser insula and/or amygdala responses to the stimuli.

Study 1

People make many inferences about personal attributes from facial features (6, 7). One fundamental such judgment is whether a person is inherently trustworthy or not (5, 8). The present study investigated whether there are reliable age differences in how older and younger adults infer trust from facial cues.

Results. Older and younger adults observed faces that had previously been selected to convey cues regarding trustworthiness (trustworthy, neutral, or untrustworthy) (4) and rated them on how trustworthy and approachable the person seemed to be. These ratings were subjected to Age group (younger vs. older) by Face Type (trustworthy, neutral, untrustworthy) mixed-model ANOVAs, with the second factor being within participants. Consistent with predictions, there was a significant age by face type interaction [$F_{(2,270)} = 7.176$, $P = 0.001$, $\eta_p^2 = 0.050$]: Faces high in trust cues were perceived as equally trustworthy by older [mean (M) = 0.952, SE = 0.075] and younger adults (M = 0.926, SE = 0.167) ($F < 1$); neutral faces were also perceived as equally trustworthy by older (M = 0.451, SE = 0.069) and younger adults (M = 0.309, SE = 0.153) ($F < 1$); in contrast, untrustworthy faces were perceived as significantly more trustworthy by older adults (M = −0.757, SE = 0.073) than by younger adults (M = −1.404, SE = 0.162) [$F_{(1,135)} = 13.267$, $P < 0.001$] (Fig. 1*A*). Thus, as predicted, older adults perceived faces conveying cues to untrustworthiness to be more trustworthy, compared with younger adults, although they did not differ in their evaluations of faces high or medium in cues related to trust.

Analyses of approachability ratings showed related patterns. A main effect of age group indicated that older adults viewed the photographed people as more approachable (M = 0.577, SE = 0.061) than younger adults (M = 0.078, SE = 0.137) [$F_{(1,137)} = 10.985$, $P = 0.001$, $\eta_p^2 = 0.074$]. These main effects were qualified by a significant age group by face trustworthiness interaction [$F_{(2,274)} = 13.735$, $P < 0.001$, $\eta_p^2 = 0.091$). Trustworthy faces were perceived as equally approachable by older adults (M = 1.478, SE = 0.075) and younger adults (M = 1.191, SE = 0.162) [$F_{(1,137)} = 2.441$, $P = 0.120$]. Similarly, older (M = 0.875, SE = 0.067) and younger adults (M = 0.635, SE = 0.150) perceived neutral faces as equally approachable [$F_{(1,137)} = 2.145$, $P = 0.145$]. However, older adults (M = −0.624, SE = 0.072) perceived untrustworthy faces to be significantly more approachable (that is, less unapproachable) than was true for younger adults (M = −1.591, SE = 0.162) ($F_{(1,137)} = 29.885$, $P < 0.001$). Thus, consistent with the trustworthiness results, older adults regarded the people pictured in the photographs as more approachable than younger adults did, and this was especially true for the faces conveying cues of untrustworthiness.

Study 1 Discussion. Older adults perceive facial cues relating to trust differently than younger adults. Although the two age groups rated faces high or neutral in trust cues similarly, older adults rated untrustworthy faces as significantly more trustworthy and approachable than younger adults did. Thus, older adults' propensity to see people as trustworthy occurs disproportionately at the untrustworthy end of the trust dimension. Essentially, then, older adults regard the faces as more similar than younger adults, who made sharper discriminations based on cues to trust. These findings provide some support for the contention that older adults' vulnerability to fraud may have at least a partial basis in a reduced

Author contributions: N.I.E., T.E.S., M.S.G., and S.E.T. designed research; N.I.E. and S.E.T. performed research; E.C., W.G.M., and I.A.B. analyzed data; and E.C., N.I.E., and S.E.T. wrote the paper.

The authors declare no conflict of interest.

[1]To whom correspondence should be addressed. E-mail: taylors@psych.ucla.edu.

This article contains supporting information online at www.pnas.org/lookup/suppl/doi:10.1073/pnas.1218518109/-/DCSupplemental.

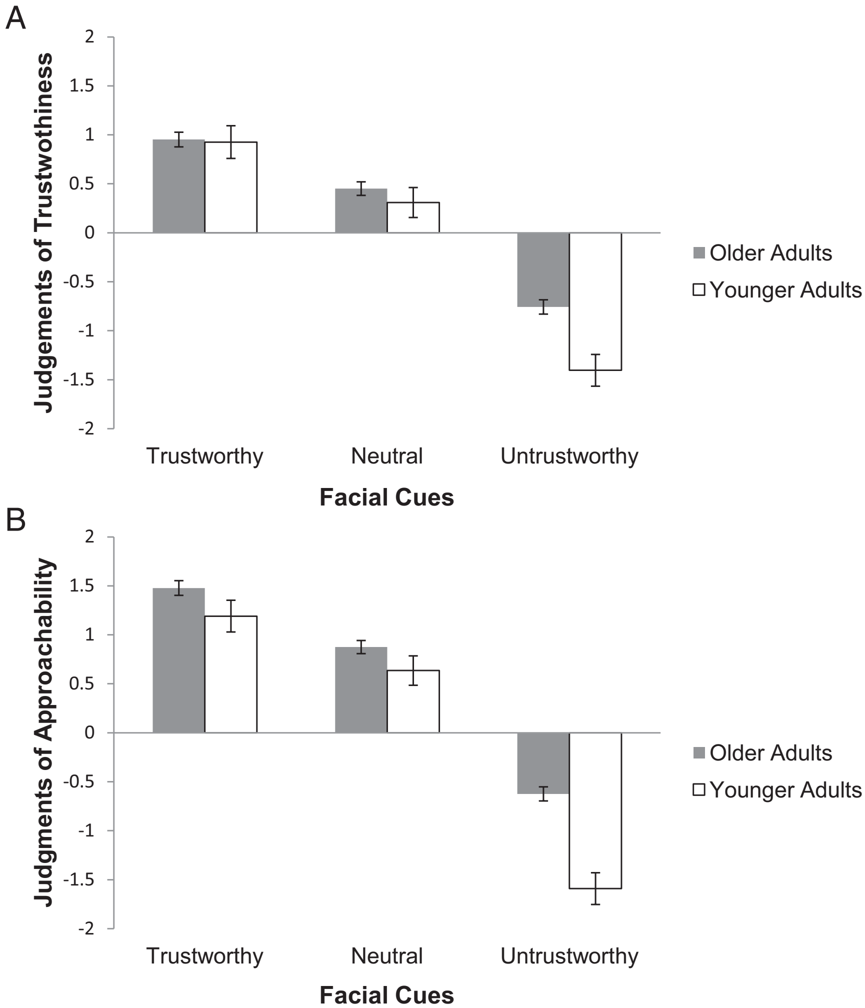

Fig. 1. Older and younger adults' ratings of the trustworthiness (*A*) and approachability (*B*) of faces varying in trust cues.

sensitivity to cues to untrustworthiness. We next examined whether older adults' lack of sensitivity to cues related to trust is reflected in patterns of neural activation.

Study 2

Study 2 examined neurocognitive mechanisms underlying age differences in perceptions of trust. Participants saw pictures of faces prerated to range in trustworthiness, which came from an expanded continuous set similar to the three discrete types of stimuli used in study 1. To identify neural processes related to explicit trust perception, participants evaluated the trustworthiness of the face by making a binary judgment of each face as either "trustworthy" or "untrustworthy" (trustworthiness judgments). As a comparison task, participants rated the same faces as either "female" or "male" (gender judgments), which involves only passive exposure to facial cues of trustworthiness. For analytic purposes, faces were divided into those perceived to be trustworthy vs. untrustworthy.

Age-related differences in explicit judgments of untrustworthy faces found in study 1 led to hypotheses regarding activation in the anterior insula (AI), a region believed to contribute to decision making by instantiating valenced subjective feeling states (9). This region has previously been implicated in assessing trustworthiness and responding to breaches in trust (10). We also examined the amygdala, a region that has been associated with processing facial cues regarding untrustworthiness (4, 5, 11).

First, we hypothesized an age by task interaction in the AI, such that compared with younger adults, older adults would show reduced activation during explicit judgments of trustworthiness. Critically, we also predicted an age by trustworthiness interaction in the AI and amygdala, such that compared with younger adults, older adults would show a muted response to untrustworthy faces.

Results. ***ROI analyses.*** Based on a priori hypotheses regarding the involvement of the AI and amygdala, we began by examining task-related effects using region of interest (ROI) analyses within anatomically defined bilateral AI and amydala ROIs.

AI ROI. We first focused on our control cohort of younger adults to identify neural activation associated with trust perception and subjected their data to a 2 (face type) × 2 (task) ANOVA. As predicted, there was a main effect of task, reflecting greater bilateral AI activity when making trustworthiness vs. gender judgments [$F_{(1,19)} = 27.51$, $P < 0.001$]. There was also a main effect of face type, such that untrustworthy (vs. trustworthy) faces led to greater activity in the bilateral AI [$F_{(1,19)} = 4.89$, $P = 0.02$]. There was no task by trustworthiness interaction [$F_{(1,19)} = 0.092$, $P = 0.383$]. In contrast, when the same ANOVA was performed for the sample of older adults, they showed no significant effects of task [$F_{(1,17)} = 0.272$, $P = 0.305$], trustworthiness [$F_{(1,17)} = 0.095$, $P = 0.381$], or task by trustworthiness [$F_{(1,17)} = 0.00$, $P = 0.497$]; these findings suggest that, consistent with their lesser sensitivity to trust cues in study 1, older adults do not show differential AI activity in response to untrustworthy vs. trustworthy faces or to making trustworthy (vs. gender) evaluations.

To compare bilateral AI activity for the age groups directly, a 2 (age) × 2 (face type) × 2 (task) ANOVA was performed. Significant main effects for age [$F_{(1,36)} = 5.3$, $P = 0.014$], face type [$F_{(1,36)} = 3.79$, $P = 0.03$], and task [$F_{(1,36)} = 7.77$, $P = 0.004$] were found, such that there was greater AI activity for younger vs. older adults overall, for untrustworthy vs. trustworthy faces, and for the trustworthy vs. gender judgments. More importantly, there was a significant age by task interaction [$F_{(1,36)} = 13.16$, $P < 0.001$] and a marginally significant age by trustworthiness interaction [$F_{(1,36)} = 2.56$, $P = 0.059$] (Fig. 2), such that younger adults showed more activation of the AI than older adults during the trust rating task and in response to untrustworthy faces. Because the age by trustworthiness interaction was marginally significant, we explored further and found that it reached significance in the left AI [$F_{(1,36)} = 2.905$, $P = 0.049$], but was only marginally significant in the right AI [$F_{(1,36)} = 1.925$, $P = 0.087$]. No other interactions were significant.

Amygdala ROI. No significant main effects or interactions were present in the amygdala in either age group when the groups were modeled separately as a 2 (trustworthiness) × 2 (task) ANOVA or when directly compared in a 2 (age) × 2 (trust level) × 2 (task) ANOVA (see *SI Text* for *F* statistics).

Whole-brain analyses. To obtain a more detailed picture of neural regions that were differentially activated as a function of age, we next conducted whole-brain analyses.

Again, we first focused on the control cohort of younger adults to identify neural activity associated with typical trust perception. The main effect of task ("all trustworthiness judgments" > "all gender judgments") revealed that younger adults show heightened activation in bilateral AI (right: 33, 23, 1; $t = 5.51$, $k = 160$; and left: −30 20 −8; $t = 4.65$; $P = 0.001$, $k = 57$; cluster extent threshold, 25 voxels), when making explicit judgments of trustworthiness, and no other neural regions reached significance. For the main effect of face type ("all untrustworthy faces" > "all trustworthy faces"), younger adults also showed heighted activation in left AI (−39, 23, −2; $t = 4.21$, $k = 66$; $P = 0.001$; cluster extent threshold, 25 voxels) and right inferior frontal gyrus (57, 32, 7; $t = 5.4$, $k = 45$; $P = 0.001$; cluster extent threshold, 25 voxels) when viewing faces with untrustworthy features across both judgment tasks, and no other neural regions reached significance. In contrast, older adults showed no neural regions that were significantly more active when making explicit judgments of trustworthiness vs. gender or when subjects were viewing untrustworthy vs. trustworthy faces. Thus, as in study 1, older adults did not appear to discriminate strongly between trustworthy and untrustworthy faces, whereas younger adults did.

Finally, to directly compare trust-related neural responses in younger and older adults, we conducted whole-brain two-sample *t* tests. To identify a whole-brain age by task interaction, the contrast "all trustworthiness judgments" > "all gender judgments" was compared in younger vs. older adults. This analysis revealed that older adults showed reduced activation in bilateral AI relative to younger adults (right: 36, 23, 1; $t = 5.21$, $k = 75$; and left: −30, 20, −2; $t = 3.26$, $k = 27$, $P = 0.001$; cluster extent threshold, 25 voxels). To identify a whole-brain age by face type interaction, the contrast "all untrustworthy faces" > "all trustworthy faces" was compared in younger vs. older adults. Effects in this contrast were too subtle to detect at threshold; however, a small left AI cluster was present when the significance threshold was reduced (−45, 32, 13; $t = 3.37$; $P < 0.005$, uncorrected).

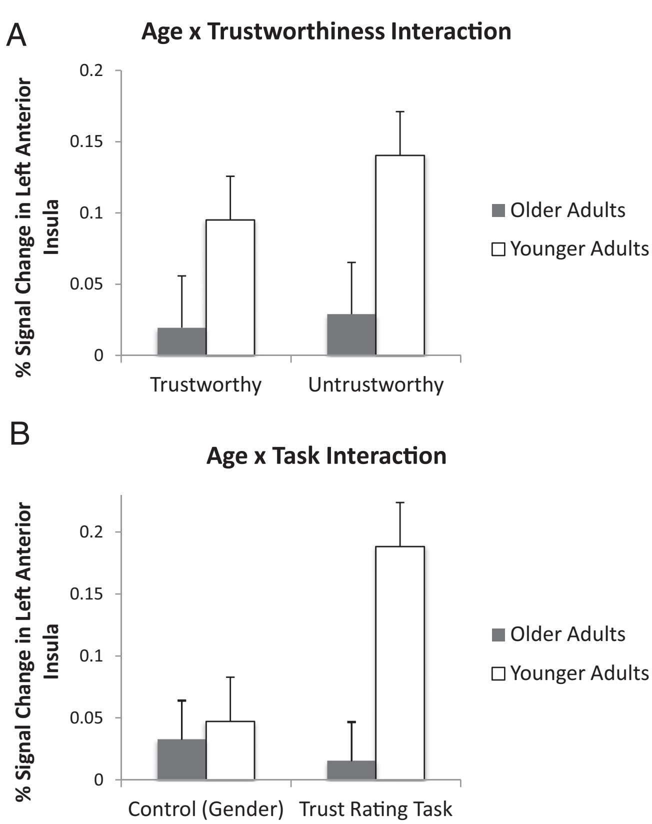

Fig. 2. Activation of left anterior insula in younger and older adults in response to facial cues (*A*) and task (*B*).

Study 2 Discussion. These results demonstrate that the AI is critical for explicitly judging trustworthiness and is particularly important for perceiving untrustworthy faces, whether or not participants are explicitly assessing trustworthiness. Consistent with predictions, each of these effects interacted with age such that, compared with younger adults, older adults show lesser AI activation when making explicit judgments of trustworthiness and when perceiving untrustworthy faces.

The AI has been implicated in reactions of disgust (9) and shown to support interoceptive awareness more generally (12). Researchers have suggested this mapping of visceral states forms the basis of "gut feelings" that inform decision making (13, 14). Previous research has also shown that neural activation in the AI is important for assessing risks (15), responding to breaches in trust (10), representing expected financial risks, and predicting choice of safer outcomes (16). Following this interpretation, reduced AI activation seen in older adults may be a neural indicator of a weaker warning signal than is present in younger adults, and as such, may be implicated in older adults' higher perceptions of trustworthiness in the presence of cues to untrustworthiness.

Although we did not expect to see an age by task interaction in the amygdala [because the threat-related amygdala response is thought to be automatic and thus should be present during both explicit and implicit (gender) perceptions of trustworthiness], our hypothesized age by face type interaction was not found. This lack of significant findings for the amygdala is a surprise, given previous research (4, 11) that implicates the amygdala in perceptions of trust. It may be that the amygdala is not engaged in responses to stimuli such as these. Specifically, the stimuli in this study did not explicitly convey emotional states, which reduces the likelihood of seeing a robust amygdala response. Alternatively, prior work (4, 11) has shown several different patterns of amygdala activation in response to trust cues, and so there is currently little basis for predicting exactly how the amygdala may be related to perceptions of trust and how that might be moderated by age.

General Discussion

Two studies, one behavioral and one using neuroimaging methodology, investigated age differences in perceived trust. Older adults rated faces high and neutral in trust cues the same as younger adults did, but perceived untrustworthy faces to be significantly more trustworthy and approachable than younger adults did. These results are consistent with research on age differences in emotion regulation. Across a variety of experiences and perceptions, older adults show a positivity bias (17): They report being happy and satisfied with life (18), they experience negative emotions after unpleasant interpersonal events less strongly than younger adults (19), they remember positive information better than negative information (20), they attend more to positive or neutral information than negative information (21), and they recover faster from negative emotions (3). This general pattern of findings is consistent with socioemotional selectivity theory (17), which posits a general pruning by older adults of negative experiences and people in ways that may foster well-being. The present results are consistent with this pattern: Older adults did not discriminate trustworthy from untrustworthy faces as sharply as younger adults did (study 1), instead regarding untrustworthy faces as more trustworthy and approachable; and older adults did not show left AI activation to untrustworthy faces as younger adults did (study 2). Thus, a visceral early warning system that may alert younger adults to be cautious in the presence of cues regarding trust/distrust may not be present to the same degree in older adults.

On the whole, this pattern of lesser sensitivity to negative cues, such as those that cue untrustworthiness, may be a benign contribution to the well-being of older adults much of the time. However, this propensity may also put older adults at risk for failing to process cues to untrustworthiness that they should attend to. As noted, the Federal Trade Commission (2) and the Federal Bureau of Investigation (1) have speculated that one reason older adults are more vulnerable than younger adults to frauds of all kinds, especially financial frauds, may be because they fail to process cues related to untrustworthiness when perceiving others, relative to younger adults.

The behavioral findings are reflected in patterns of neural activation in response to cues of trustworthiness. Younger adults showed preferential activation of the AI both when making ratings of trustworthiness and when viewing untrustworthy faces. The results indicated no significant activation of the AI during older adults' evaluations of trustworthiness or viewing of untrustworthy faces. The AI is critical for creating interoceptive (feeling-based) representations of visceral cues, which can be thought of as "gut feelings" (9, 22, 23), and people with lower interoceptive awareness experience less arousal in response to negative emotional stimuli (24). Consistent with this analysis, AI activity has been shown to represent expected risk and to predict risk aversion in a monetary game (16), suggesting that the heightened negative visceral feelings associated with AI activity might aid in risk aversion. Importantly, interoceptive awareness tends to decline with age (25), and compared with younger adults, older adults show muted left AI activation when anticipating monetary loss (26), which supports the interpretation of AI activity as a visceral "warning signal." The present study connects these two lines of research by suggesting that a diminished interoceptive "gut response" in older adults contributes to their tendency to be trusting, with the possibility that it affects vulnerability to fraud and poor financial decision making.

An alternative explanation for the results is that people who are older at this particular point in time process cues to untrustworthiness differently than younger adults, both behaviorally and in the brain, i.e., a cohort effect. That is, the current older cohort may simply be a more trusting one. A second alternative explanation is that more positive and trusting people live longer (i.e., selective mortality). Several investigations, however, have shown that the balance of positive to negative experience that changes with age is seen over time and is not particular to one particular cohort. For example, there is a steady improvement in the ratio of positive to negative experience across adulthood. This process becomes evident sufficiently early in adulthood to refute the possibility that enhanced well-being in late life simply reflects the experience of one cohort or selective mortality of more trusting people (27, 28).

The present results are consistent with older adults' general positivity bias in person perception and with their heightened vulnerability to fraud, a vulnerability that has been credited to being overly trusting (1, 2). However, studies using economic game-type formats sometimes find that older adults are more cautious in their willingness to invest (e.g., refs. 29, 30), although the evidence is mixed (31). This paradigm difference in age-related findings may be due to older adults' unfamiliarity with economic games. Alternatively, certain kinds of cues (faces) may evoke different responses than other kinds of cues (e.g., proposed monetary transfer in an economic game); such instructions may make older adults more cautious, given possible reduced financial circumstances. Older adults do, however, provide larger rewards to people who have invested in them, reflecting a heightened trustworthiness. Studies have also shown that older adults are actually less afraid of being victimized, despite their greater vulnerability to many kinds of crime (32).

The consequences of misplaced trust for older adults are severe. A recent study estimates that older adults (over 60) lost at least $2.9 billion in 2010 to financial exploitation, ranging from home repair scams to complex financial swindles (33). This figure represents a 12% increase from 2008. Older adults' reduced sensitivity to cues related to trust may partially underlie this vulnerability.

Conclusion

Older adults perceive faces conveying cues of untrustworthiness as more trustworthy and approachable than younger adults. Differences in activation of the AI observed when evaluating trustworthiness and in response to cues suggestive of untrustworthiness may underlie this age difference. As such, older adults may have a lower visceral warning signal in response to cues of untrustworthiness, which could make deciding whom to trust difficult, and may at least partially underlie their vulnerability to fraud. All participants provided written informed consent according to the procedures of the UCLA Institutional Review Board.

Methods

Study 1. Participants were 143 adults (40 men and 103 women). The sample was composed of 119 older adults (aged 55–84, M = 68.76, SD = 6.601) and a comparison group of 24 younger adults (aged 20–42, M = 23.21, SD = 5.090) who completed a study of "perception of personal qualities." The younger adults were students and employees at a large Western university, and the older adults were residents of a retirement community. The education levels of the older adults ranged from some high school to postgraduate degrees, and the younger adults had at least some college; there was no overall difference in education level. All participants provided written informed consent according to the procedures of the UCLA Institutional Review Board.

Participants saw and rated frontal images of faces that encompass a range of cues related to trustworthiness, a task developed by Adolphs et al. (4). All pictures are gaze-forward images of approximately equal size and equivalent background and picture both genders and an array of ages. For the stimuli in study 1, we chose 10 faces that had been previously been selected to be trustworthy, 10 faces selected to be neutral, and 10 faces selected to be untrustworthy (4). Participants rated, on 7-point scales, the extent to which each face was "very untrustworthy (−3) to very trustworthy (3)" and the extent to which each face was "very unapproachable (−3) to very approachable (3)."

Following this task, participants completed questionnaires assessing dispositional trust (34), future time perspective (35), and loneliness (36). Analyses concerning these measures appear in *SI Text*.

Study 2. ***Participants.*** Forty-four healthy right-handed participants screened for health, psychological, and cognitive counterindications participated in a functional magnetic resonance imaging (fMRI) study of trust perception. The sample consisted of 23 older adults (aged 55–80, M = 66.39, SD = 6.11; 12 females), recruited with the help of the Recruitment Core of the

PSYCHOLOGICAL AND COGNITIVE SCIENCES

University of California, Los Angeles (UCLA) Older Americans Independence Center, from Los Angeles retirement centers and communities. Education level ranged from some high school to postgraduate degree. All participants provided written informed consent according to the procedures of the UCLA Institutional Review Board. The comparison group was 21 younger adults (aged 23–46, M = 33.24, SD = 7.51; eight females) recruited from the broader Los Angeles community who also had an education level ranging from some high school to postgraduate degree. On the day of each participant's appointment, we administered the Mini Mental State Examination (MMSE) and used a cutoff of 23 out of 30. On the basis of this score and responses to the physiological screener (a repeat of the telephone screener used initially), one participant was excluded. Subsequent to completing the fMRI study, five older participants were excluded from analysis, three for movement greater than 3 mm within each run and two for strokes not reported during screening, leaving 39 participants total.

Stimuli. A set of grayscale frontal images, expanded from study 1, of 60 gaze-forward male and female faces of varying ages, set to approximately the same size and equivalent background contrast were the stimuli. These images were selected to represent of the full range of trustworthiness (4).

Psychological task. The scanning session for each participant was divided into two runs, a target task run and a control task run. In the target task, participants made a binary trustworthiness judgment ("Is this person trustworthy or untrustworthy?"), and in the control task, participants made a binary gender judgment ("Is this person male or female?"). All participants viewed the task through fMRI stimulus presentation goggles and responded using their right hand to make a button press. Before the start of each run, participants viewed a screen indicating which judgment to make, "Trust" or "gender." Both runs were of an event-related design, with 60 faces presented sequentially for 2 s each, with a 3- to 6-s variable interstimulus interval fixation cross displayed between each face. A similar task was previously used by Winston et al. (5). The same 60 faces were used for both the trust and gender judgment tasks; however, there was a different standardized face order for each task, and the run order was counterbalanced between participants. After scanning, participants were shown the faces again (in a different order) and asked to rate each face for trustworthiness and approachability using a 1–7 Likert scale.

Study 2: Image Acquisition and Data Analysis. Participants were scanned during task performance using a Siemens 3-tesla Trio MRI scanner with 12-channel head coil at the UCLA Ahmanson-Lovelace Brain Mapping Center. See *SI Text* for the scanning parameters and preprocessing steps.

An event-related first-level model was specified, in which events were modeled as zero duration and convolved with a canonical hemodynamic response function. Each face condition (trustworthy and untrustworthy) was modeled separately for each task (gender and trust judgments), and appropriate linear contrasts were applied to the design to enable determination of regions active for each condition between the tasks. All first-level contrast images were entered into a two-sample t test random-effects analysis to investigate age differences at the group level. Unless otherwise specified, whole-brain analyses were conducted using a statistical criterion of at least 25 voxels exceeding a voxelwise threshold of $P < 0.001$. This joint voxelwise and cluster-size threshold corresponds to a false-positive discovery rate of 5% across the whole brain, as estimated by a Monte Carlo simulation implemented using AlphaSim in AFNI (37). ROI analyses were performed using the Marsbar toolbox (http://marsbar.sourceforge.net) to estimate average percentage signal change across all voxels in each ROI. All anatomical ROIs were defined using the Wake Forest University PickAtlas anatomical toolbox (http://fmri.wfubmc.edu/cms/software#PickAtlas; ref. 38). The insula ROI was cut off at 15 in the y direction to restrict analysis to anterior regions.

ACKNOWLEDGMENTS. This research was supported by National Institute on Aging–National Institutes of Health Grants AG030309 and P30AG028748. We also received project assistance from the University of California, Los Angeles, Community Academic Partnership for Research in Aging Center under National Institutes of Health Grant 1RC4AG038182-01.

1. Federal Bureau of Investigation (2001) *Fraud Against the Elderly.* Available at www.fbi.gov/congress/congress01/lormel0910.htm. Accessed July 17, 2008.
2. Federal Trade Commission (2007) *Telemarketing Fraud Against Older Americans.* Available at www.ftc.gov/reports/Fraud/fraudcon.shtm. Accessed August 28, 2008.
3. Carstensen LL, Pasupathi M, Mayr U, Nesselroade JR (2000) Emotional experience in everyday life across the adult life span. *J Pers Soc Psychol* 79(4):644–655.
4. Adolphs R, Tranel D, Damasio AR (1998) The human amygdala in social judgment. *Nature* 393(6684):470–474.
5. Winston JS, Strange BA, O'Doherty J, Dolan RJ (2002) Automatic and intentional brain responses during evaluation of trustworthiness of faces. *Nat Neurosci* 5(3):277–283.
6. Ekman P, Friesen WV (1975) *Unmasking the Face* (Prentice Hall, Englewood Cliffs, NJ).
7. McArthur LZ, Post DL (1977) Figural emphasis and person perception. *J Pers Soc Psychol* 13:520–535.
8. Todorov A, Pakrashi M, Oosterhof NN (2009) Evaluating faces on trustworthiness after minimal time exposure. *Soc Cogn* 27:813–833.
9. Damasio A (1999) *The Feeling of What Happens: Body and Emotion in the Making of Consciousness* (Harcourt Brace, New York).
10. Rilling JK, Sanfey AG (2011) The neuroscience of social decision-making. *Annu Rev Psychol* 62:23–48.
11. Todorov A, Baron SG, Oosterhof NN (2008) Evaluating face trustworthiness: A model based approach. *Soc Cogn Affect Neurosci* 3(2):119–127.
12. Critchley HD, Wiens S, Rotshtein P, Ohman A, Dolan RJ (2004) Neural systems supporting interoceptive awareness. *Nat Neurosci* 7(2):189–195.
13. Naqvi N, Shiv B, Bechara A (2006) The role of emotion in decision making: A cognitive neuroscience perspective. *Curr Dir Psychol Sci* 15:260–264.
14. Weierich MR, et al. (2011) Older and wiser? An affective science perspective on age-related challenges in financial decision making. *Soc Cogn Affect Neurosci* 6(2): 195–206.
15. Meyer-Lindenberg A (2008) Psychology. Trust me on this. *Science* 321(5890):778–780.
16. Knutson B, Bossaerts P (2007) Neural antecedents of financial decisions. *J Neurosci* 27 (31):8174–8177.
17. Carstensen LL (2006) The influence of a sense of time on human development. *Science* 312(5782):1913–1915.
18. Diener E, Diener C (1996) Most people are happy. *Psychol Sci* 7:181–185.
19. Birditt KS, Fingerman KL, Almeida DM (2005) Age differences in exposure and reactions to interpersonal tensions: A daily diary study. *Psychol Aging* 20(2):330–340.
20. Charles ST, Mather M, Carstensen LL (2003) Aging and emotional memory: The forgettable nature of negative images for older adults. *J Exp Psychol Gen* 132(2): 310–324.
21. Mather M, Carstensen LL (2003) Aging and attentional biases for emotional faces. *Psychol Sci* 14(5):409–415.
22. Critchley HD, Mathias CJ, Dolan RJ (2001) Neuroanatomical basis for first- and second-order representations of bodily states. *Nat Neurosci* 4(2):207–212.
23. Craig AD (2009) How do you feel—now? The anterior insula and human awareness. *Nat Rev Neurosci* 10(1):59–70.
24. Pollatos O, Gramann K, Schandry R (2007) Neural systems connecting interoceptive awareness and feelings. *Hum Brain Mapp* 28(1):9–18.
25. Khalsa SS, Rudrauf D, Tranel D (2009) Interoceptive awareness declines with age. *Psychophysiology* 46(6):1130–1136.
26. Samanez-Larkin GR, et al. (2007) Anticipation of monetary gain but not loss in healthy older adults. *Nat Neurosci* 10(6):787–791.
27. Carstensen LL, et al. (2011) Emotional experience improves with age: Evidence based on over 10 years of experience sampling. *Psychol Aging* 26(1):21–33.
28. Sutin AR, et al. Cohort effect on well-being: The legacy of economic hard times. *Psychol Sci*, in press.
29. Fehr E, Fischbacher U, von Rosenbladt B, Schupp J, Wagner GG (2003) A nation-wide laboratory: Examining trust and trustworthiness by integrating behavioral experiments into representative surveys. Working Paper 866. Institute for the Study of Labor. Available at http://ssrn.com/abstract=385120. Accessed September 25, 2012.
30. Bellemare C, Kröger S (2007) On representative social capital. *Eur Econ Rev* 51: 183–202.
31. Sutter M, Kocher MG (2007) Trust and trustworthiness across different age groups. *Games Econ Behav* 59:364–382.
32. Ferraro KF, LaGrange RL (1992) Are older people most afraid of crime? Reconsidering age differences in fear of victimization. *J Gerontol* 47(5):S233–S244.
33. MetLife Mature Market Institute (2011) The MetLife study of elder financial abuse: Crimes of occasion, desperation, and predation against America's elders. Available at www.preventelderabuse.org/documents/mmi-elder-financial-abuse.pdf. Accessed June 18, 2012.
34. Yamagishi T, Cook KS, Watabe M (1998) Uncertainty, trust, and commitment formation in the United States and Japan. *Am J Sociol* 104:165–194.
35. Lang FR, Carstensen LL (2002) Time counts: Future time perspective, goals, and social relationships. *Psychol Aging* 17(1):125–139.
36. Russell D, Peplau LA, Cutrona CE (1980) The revised UCLA Loneliness Scale: Concurrent and discriminant validity evidence. *J Pers Soc Psychol* 39(3):472–480.
37. Forman SD, et al. (1995) Improved assessment of significant activation in functional magnetic resonance imaging (fMRI): Use of a cluster-size threshold. *Magn Reson Med* 33(5):636–647.
38. Maldjian JA, Laurienti PJ, Kraft RA, Burdette JH (2003) An automated method for neuroanatomic and cytoarchitectonic atlas-based interrogation of fMRI data sets. *Neuroimage* 19(3):1233–1239.