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Age Differences in the Impact of Emotional Cues on Subsequent Target Detection

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AGE DIFFERENCES IN THE IMPACT OF EMOTIONAL CUES ON SUBSEQUENT TARGET DETECTION

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AGE DIFFERENCES IN THE IMPACT OF EMOTIONAL CUES ON SUBSEQUENT TARGET DETECTION

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AGE DIFFERENCES IN THE IMPACT OF EMOTIONAL CUES ON SUBSEQUENT TARGET DETECTION

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Emotional cues within the environment capture our attention and influence how we perceive our surroundings. Past research has shown that emotional cues presented before the detection of a perceptual gap can actually impair the perception of elementary visual features (e.g., the lack of detail creating a spatial gap) while simultaneously improving the perception of fast temporal features of vision (e.g., the rapid onset, offset, and re-emergence of a stimulus). This effect has been attributed to amygdalar enhancements of visual inputs conveying emotional features along magnocellular channels. The current study compared participants' ability to detect spatial and temporal gaps in simple stimuli (a Landolt Circle) after first being exposed to a facial cue in the periphery. The study was an attempt to replicate past research using younger adult samples while also extending these findings to an older adult sample. Unlike younger adults, older adults generally display an attentional bias toward positive instead of negative emotional facial expressions. It is not clear if this positivity bias is strictly driven by cognitive control processes or if there is a change in the human visual system with age that reduces the amplification of negative emotive expressions by the amygdala. The current study used psychophysical data to determine if the rapid presentation of an emotional cue and subsequent perceptual target to older adults leads to the same benefit to temporal vision evinced by younger adults or if amygdalocortical enhancements to perception degrade with age. The current study was only able to partly replicate findings

from past research. The negative facial cues that were presented in the periphery did not lead to an enhancement in temporal gap detection for the younger adult sample nor a reduction in spatial gap detection. In fact, the opposite was found. Younger adults' spatial gap detection benefitted from the negative emotional cues. The negative and neutral emotional cues had no effect on the older adult sample. The older adults' performance on both gap detection tasks was not impacted by the emotional cues

Chapter 1: Introduction

As we age, the impact that emotion has on the way that we perceive stimuli in our environment changes. This study examined the effects of aging on spatiotemporal vision and how emotion can differentially enhance and disrupt this ability in younger and older adults. Psychophysical measures are often used to characterize emotion-induced visual system enhancements (i.e., seeing better once emotional cues enter the environment), and these methods were particularly valuable for understanding older adults' reactions to emotional stimuli. These methods have been supported by neuroimaging studies that provide some evidence as to the process by which different emotion-sensitive regions of the brain are activated by emotional images. Interestingly, cortical and subcortical areas are activated to different degrees depending on the type and intensity of emotion presented in stimuli. In turn, differential activation patterns created by emotional stimuli are associated with specific differences in subsequent behavioral responses as well. Recent research demonstrates that emotion processing in cortical regions of the brain may vary as a function of age. The current study was conducted to help improve our understanding of how age differences in emotion processing emerge and thus help to evaluate the validity of two possible explanations that are commonly used to account for these age-related differences in emotion processing.

Emotion Captures Attention

Throughout the course of human existence, our ability to detect an emotional stimulus has evolved in order to increase our likelihood of survival. The natural ability to detect facial expressions has developed in conjunction with communication, which is important for the establishment of a dominance hierarchy within social groups (Öhman &

Mineka, 2001). Emotional stimuli are processed rapidly and preconsciously to facilitate responding to stimuli in the environment (Compton, 2003). In Öhman, Lundqvist, and Esteves (2001), participants detected threatening facial expressions within a crowd faster than nonthreatening expressions, suggesting that fear-evoking features of stimuli are influential in capturing attention. Öhman et al. (2001) also described emotional stimuli as guiding attention in the environment; working as a spotlight, attention is shifted toward stimuli that are deemed relevant in the environment to the observer.

The amount of attention that is focused upon a particular stimulus depends on the level of personal value placed on it by the viewer. The amygdala of the viewer then allocates attention based on this value as well as the potential for inducing arousal. Due to the need for survival, a threatening stimulus captures more attention, which leads to a higher level of activation in the amygdala. Facial and non-facial stimuli both activate the amygdala; however, there is greater activation for facial expressions in the right amygdala, and greater activation for non-facial stimuli in the left amygdala (Adolphs, Jansari, & Tranel, 2001; Hariri, Tessitore, Mattay, Fera, & Weinberger, 2002; Phelps et al., 2001). Lateralization of amygdalar functioning is essential for conscious and unconscious emotion processing. The right amygdala unconsciously processes emotion without any awareness, and the left consciously processes emotion (Lane & Nadel, 2000). Overall, there is increased activation of the left amygdala when there is a fearful or threatening stimulus presented, and, as the intensity of the stimulus increases, activity in the left amygdala increases (Lane & Nadel, 2000; Phelps et al., 2001). Overall amygdala activation is more prevalent for facial expressions that indicate a threat or danger in the environment because the face activates the right amygdala and the threat activates the left amygdala (Hariri et al., 2002; Lane & Nadel, 2000). For example, if someone is approaching you with a fearful expression on his/her face, you are going to be alerted to a possible threat and can escape without harm.

Evolution has provided us with the ability to gather information from people in our environment based on their faces alone. We can detect who the person is and the emotion or combination of emotions expressed on an individual's face. This visual information is passed from the retina to the thalamus which re-directs signals to subcortical regions, like the amygdala, and cortical regions throughout the visual system. When determining whether damage to the amygdala would cause impairments in emotion recognition, Adolphs and colleagues found that bilateral amygdala damage is associated with impairments in the recognition of fearful facial expressions (Adolphs, et al., 1999; Adolphs, Tranel, Damasio, & Damasio, 1994). People with amygdala damage can still have many of their natural abilities, but they no longer have the ability to process emotionally or socially meaningful information depicted by fearful or threatening stimuli (Adolphs et al., 1994, 1999, 2005). Additionally, despite the deficit associated with detecting fearful or threating stimuli, no difference exists between people with amygdala damage and people with normal amygdala functioning when considering positive emotional stimuli (Adolphs, et al., 1994, 1999, 2005). Adolphs et al. (2005) went on to conclude that the impairment stems from the amygdala failing to direct the visual system to seek out information, and to use this information to identify those emotions. This failure could be attributed to the loss of connections between the thalamus and the amygdala, or to the pathways that connect the amygdala to the visual system through the thalamus.

Amygdala-Cortical Interaction Facilitates Perception

When an emotional stimulus activates the amygdala, that activation occurs fast enough to aid the evasion of the threat. Hung et al. (2010) suggest that threat related information is processed by the amygdala through a fast subcortical pathway and a slow cortical feedback pathway. However, other researchers have suggested that threat-evoked amygdala activation modulates the transmission of information along two types of neural pathways within the cortex instead of via subcortical paths (Pessoa, 2013). Specifically, visual input travels from the retina to the primary visual cortex and throughout associated visual regions via magnocellular and parvocellular neuronal channels. Magnocellular pathways, like those extending from rod cells in the retina, have neurons with larger receptive fields and are selective for coarse low spatial frequency information at low contrast (Bocanegra & Zeelenberg, 2009; Holmes, Green, & Vuilleumier, 2005). In general, magnocellular pathways provide information that is necessary for the perception of movement, depth, and small differences in brightness. On the other hand, parvocellular pathways, like those that originate in retinal cone cells, have neurons with smaller receptive fields and are selective for fine-grained high spatial frequency information at high luminance contrast (Bocanegra & Zeelenberg, 2009; Holmes et al., 2005). When a threatening visual stimulus is presented, both pathways are activated simultaneously; however, the amygdala facilitates the transmission of threat-related information along the magnocellular pathway hastening responses where one is asked to locate a threatening stimulus. The temporal advantage conferred to threatening information via the magnocellular connections between the amygdala and visual cortical regions might have evolved to ensure the timely detection of threat in one's environment. Information travels along the parvocellular pathway more slowly but is nevertheless important to identifying threat. The relative difference in the timing of the transmission of information along each pathway has been the subject of a number of studies by Bocanegra and Zeelenberg (2009, 2011a, 2011b).

In order to test the hypothesis that threatening visual stimuli facilitate spatial-temporal visual processing while impairing one's ability to perform processing of more fine details, Bocanegra and Zeelenberg (2009) presented fearful face cues and neutral face cues immediately before a stimulus containing low or high spatial frequency information. Participants were to judge the orientation of this second stimulus (i.e., a Gabor patch). The stimuli used in their experiment were presented at different levels of spatial frequency. The level of spatial frequency was dependent on the number of gratings within the image. A high spatial frequency image has many narrow grating bars within each degree of visual angle, whereas a low spatial frequency image has fewer and wider bars. Given the advantage that magnocellular neuronal pathways have over parvocellular pathways in transmitting threat-related visual information, Bocanegra and Zeelenberg (2009) expected to find a deficit in the detection of the orientation of the high spatial frequency stimulus and an enhancement in the detection of the orientation of a low spatial frequency stimulus. They hypothesized that the low spatial frequency threatening facial input triggers a cascade of transmissions along the magnocellular pathway that enhances one's ability to detect low spatial frequency stimuli. In fact, their predictions were confirmed in that the proposed effects of threatening cues on the orientation judgments emerged whenever low spatial frequency facial cues were presented and not when facial cues consisted only of high spatial frequency information. These findings are taken as evidence that magnocellular pathways are facilitating activation of the amygdala in synchrony with other areas of the brain (Bocanegra & Zeelenberg, 2009).

The findings presented by Bocanegra & Zeelenberg (2009) correspond with the findings from Phelps, Ling, and Carrasco (2006) demonstrating that emotion facilitates early visual processing, and that a fearful face enhances contrast sensitivity. Contrast sensitivity was enhanced when a target appeared in the same location as a fearful face that was being used as an attentional cue (Phelps et al., 2006). Based on their findings, Bocanegra and Zeelenberg (2009) hypothesized that emotional stimuli may cause a trade-off between magnocellular and parvocellular pathways. If a fearful stimulus is detected, parvocellular pathways and magnocellular pathways send information to the amygdala, thalamus, and visual system. Once the information has made it to the proper brain regions and a response to avoid the threat has been generated, further processing by the pathways continue sending the fine-grained details to these brain regions for identification of the threat. Bocanegra and Zeelenberg (2009) suggest that there is an interchannel trade-off in which facilitation of magnocellular processing is accompanied by an inhibition of parvocellular processing. This allows for faster threat detection followed by the processing of information to identify exactly what the threat is.

Amygdalar enhancements following the presentation of fearful faces have also been found to be temporal in nature. Bocanegra and Zeenlenberg (2011a) presented fearful and neutral faces before a gap detection test to see how emotional stimuli impact spatiotemporal vision. The gap detection task included trials in which participants judged a temporal gap (i.e., detecting a timing gap, or blank screen, presented between sequential onset of two circle stimuli) and trials in which participants judged a spatial gap (i.e., detecting a small physical gap in a circle stimulus); such judgments occurred immediately after the facial cue. The presentation of a fearful face before the gap detection test impaired the participant's ability to detect the spatial gap, but it facilitated the detection of the temporal gap. Just as in their previous findings (Bocanegra & Zeelenberg, 2009), Bocanegra and Zeelenberg (2011a) concluded that there is a trade-off between the pathways depending on the information being detected. The fearful face signaled to the amygdala that there was a possible threat, which then facilitated the processing of the magnocellular pathway to determine where the threat was. The parvocellular pathways were suppressed, perhaps because it is more important to know where the threat is so that it can be evaded. After the threat has been evaded, the fine-grained details from the parvocellular pathway become relevant for the identification of details about the exact nature of the threat (Bocanegra & Zeelenberg, 2011b; Holmes et al., 2005; Hung et al., 2010).

Bocanegra and Zeelenberg's (2011a) research relied on only a younger adult sample, and it is not known whether these results will hold true for older adults. In an experiment using a Dot-Probe task (a test used to assess selective attention to threatening stimuli), younger adults were faster to respond with the location of the probe after an emotional face was presented because the emotional face heightened attention to detect the probe (Mather & Carstensen, 2003). However, in the same task older adults' response time to the probe was slowed if it appeared in the place formerly occupied by a negative emotional face, presumably because older adults directed less attention to location previously occupied by the negative expression (Mather & Carstensen, 2003). Other studies have indicated that the process of aging may lead to a decline in the discrimination of emotional faces (Isaacowitz et al., 2007; Isaacowitz & Stanley, 2011; Mienaltowski, Corballis, Blanchard-Fields, Parks, & Hilimire, 2011; Orgeta & Phillips, 2008; Ruffman, Henry, Livingstone, & Phillips, 2008). When asked to identify facial expressions, accuracy for negative emotions is worse for older adults than for younger adults, when the stimulus is presented at low intensity (Isaacowitz et al., 2007; Mienaltowski et al., 2013; Orgeta & Phillips, 2008). Specifically, older adults had greater difficulty recognizing fearful faces (Orgeta & Phillips, 2008; Ruffman et al., 2008), but were better at detecting happy faces than younger adults (Isaacowitz & Stanley, 2011). Mienaltowski and colleagues (2013) found conflicting results for age-related differences in emotion discrimination. There were age differences for fearful expressions, but these differences only emerged when the stimulus was presented at lower levels of intensity. These age differences in emotion recognition emerge early after the detection of the stimuli (Hilimire, Mienaltowski, Blanchard-Fields, & Corballis, 2014).

In an attempt to explain these age-related differences, Ruffman et al. (2008) suggested that physiological changes in the brain are the reason for the decline in accuracy for older adults. These physiological changes could be due to the loss of connections between key brain structures. If there is a problem detecting a fearful stimulus, it may be because there was a loss of connectivity between the amygdala and the visual system. Further research on connectivity was conducted by St. Jacques, Dolcos, and Cabeza (2010) who wanted to identify whether or not activity related to emotional function was preserved during aging. Using functional magnetic resonance imaging (fMRI), they found that there was an age-related difference in amygdala lateralization. When presented with a negative image, younger adults showed more activation in the left amygdala, whereas older adults showed greater activation in the right amygdala (St. Jacques et al., 2010). Greater activation in the left amygdala was interpreted as indicating that younger adults were more focused on the negativity in the image, but greater activation in the right amygdala for older adults suggests that they were not focused on the negativity (Lane & Nadel, 2000; Mather et al., 2004). Older adults' enhanced processing for happy expressions suggests that there may be a neural mechanism that shifts attention toward positive emotional stimuli early on after their appearance. St. Jacques and colleagues also found that there was an age-related increase in the co-activation of brain regions that are used in controlled processes to shift attention toward positive emotional stimuli, suggesting that older adults were regulating their emotional responses and possibly suppressing the perception of negative stimuli (St. Jacques et al., 2010). This possible use of emotion regulation strategy was proposed by the authors and supported by others (Mather, 2012) given that older adults' increase in prefrontal activity after the onset of a negative stimulus was coupled with lower levels of activation in the amygdala and reduced posterior region activation, possibly signaling a reduction in perceptual processing of negative emotional stimuli.

Explanation for Age-Related Differences in Emotion Perception

As noted above, amygdala activation for negative stimuli decreases with age. Interestingly, activation for positive stimuli is maintained across age groups (Kisley, Wood, & Burrows, 2007; Mather et al., 2004). Negative emotional information is typically more potent, but cognitive control is used by older adults to divert their focus away from negative stimuli (Kisley et al., 2007). Younger adults display a negativity bias in that they tend to focus more on the negative things in life than the positive, possibly conferring a survival advantage. On the other hand, older adults show a positivity bias in that they are more likely to pay attention to positive rather than negative stimuli (Leclerc & Kensinger, 2011; Mather & Carstensen, 2005; Reed & Carstensen, 2012; St. Jacques et al., 2010). Hilimire et al. (2014) used event-related potentials (ERP) to determine the earliest time that younger and older adults' responses to emotional faces might diverge, eliciting a negativity bias in young adults and a positivity bias in older adults. The authors examined age differences in electric potentials captured by frontal electrodes from 100-300 ms after the onset of emotional faces, or during the early stages of emotion processing. They hypothesized that, if the positivity bias is evident in the early time window before cognitive control processes are implemented, then the positivity bias emerges from automatic processes rather than through purposeful emotion regulation. Hilimire et al. (2014) found that, in the earliest time window (110-130ms), younger adults showed a larger voltage change in response to negative faces relative to neutral faces, but older adults showed a larger voltage change for happy faces relative to neutral faces. These findings were consistent with an early negativity bias emerging for younger adults after the onset of emotional facial stimuli and an early positivity bias for older adults. This positivity bias in older adults might be explained by Socio-Emotional Selectivity Theory (SST), which postulates that older adults prioritize emotional goals to a higher extent than young adults do and thus intentionally allocate cognitive resources toward positive rather than negative stimuli as a means of mood regulation and to maintaining positive emotional meaning in their everyday experiences (Carstensen, 2006).

Another possible explanation for the aforementioned age-related differences in emotion perception and the positivity effect is the Aging Brain Model (ABM). Whereas SST is motivationally driven, the ABM argues that the age differences are due to physiological changes within the brain itself (Cacioppo, Berntson, Bechara, Tranel, & Hawkley, 2011; Cacioppo, Gardner, & Berntson, 1997). Aging impairs the functioning of the amygdala and connectivity to other brain regions (Addis, Leclerc, Muscatell, & Kensinger, 2010; Erk, Walker, & Abler, 2008; Fischer, Nyberg, & Bäckman, 2010). The reduced reactivity leads to subsequent reduction in the emotional impact of negative, but not positive stimuli. Age differences do not only reflect an overall decline in the functioning of the amygdala, but instead also reflect a shift in the type of emotional stimuli to which it is most responsive. The shift from negative to positive emotional stimuli could be due to older adults showing reduced reactivity to negative stimuli given the changes in how the amygdala responds to their presence. In other words, unless specifically attended to, negative features of emotional stimuli do not create the same sweeping cascade of alertness across the cortex of older adults that they do for younger adults. Both models predict that amygdala activation will be comparable for positive stimuli in young adults and will be smaller for negative than positive stimuli in older adults, but, again, the ABM predicts that this difference is caused by degeneration of the brain and not by a conscious choice.

Current Study

Emotional stimuli are everywhere in our environment. Those that capture our attention the most are the ones that we place a higher personal value on and deem relevant for greater amygdala activation in that situation. The primal instinct that elicits a fear response also impacts the way that we perceive other things in that moment. As Bocanegra and Zeelenberg (2011a) found, our ability to perceive fine-grained detail or spatiotemporal information about a stimulus can be impacted by an emotional cue presented just before this stimulus. A fear-evoking cue can immediately facilitate the perception of the temporal features of a subsequent target stimulus but suppresses the fine-grained spatial features of this same stimulus. Specifically, the amygdala enhances the transmission of information traveling along magnocellular channels to facilitate one's ability to locate the threat in space and to escape, while suppressing the information traveling along parvocellular channels until that information is relevant to identify the threat.

The current study attempted to replicate and extend Bocanegra and Zeelenberg's research (2011a) by examining how facial expressions impact younger and older adults' ability to detect visual gaps. Specifically, physical gaps in a stimulus (spatial gap) or gaps in the continuity of the appearance of a stimulus (temporal gap). Participants were asked to make gap discrimination judgments after an arousing negative facial expression was presented. Based on past research, it was expected that the fleeting emotional expressions observed on the face just before the gap judgment would influence the gap judgment in an automatic and uncontrollable way. There is further interest in finding evidence for this possibility in adults of all ages because having this information helps us understand how social factors in our environment influence very simple and basic functions of our senses. Replicating the gap discrimination task of Bocanegra and Zeelenberg (2011a), older and younger adults were presented with a cue (angry or neutral faces) followed by a gap detection judgment (spatial or temporal). Younger and older adults' performance on the two gap judgments were compared to determine if the facilitation of temporal judgments initiated by the amygdala of younger adults could also be found with an older adult sample.

As mentioned earlier, SST and ABM offer different perspectives on the mechanisms underlying age differences in emotion perception and in how we respond to emotional stimuli. SST offers a motivational account for age differences and suggests that, as we age, we shift our focus from negative to positive aspects of life. Based on SST, older adults should behave the same as younger adults when completing the gap detection task because the task does not afford any time for cognitive control. Consequently, older adults would not have time to temper their reactions to angry faces and should behave like younger adults. The second account, ABM, suggests that natural changes in the brain that accompany advancing age lead to age differences in the value added to stimuli by emotion. More specifically, aging causes connections in the brain to weaken and breakdown throughout life. The age-related degradation could impact the way that emotions are perceived later in life. The ABM suggests that older adults cannot behave like younger adults because connections between the amygdala and the visual system have been degraded. Consequently, although angry faces should facilitate younger adults' temporal gap judgments and impair their spatial gap judgments, the emotion on the facial cues might not impact older adults' performance on the two types of gap judgments. It was not known in advance if younger and older adults would differ in their behavior because this task had never been presented to older adults before. Older adults could have behaved just like younger adults, but it was possible that older adults would show weakened or null effects given their diminished sensitivity to negative expressions and possible degradation in their connectivity between the amygdala and other cortical regions.

Chapter 2: Method

Overview

A 2 (age Group: younger and older adults) x 2 (cue Condition: angry and neutral) x 2 (gap judgment task type: timing gap and spatial gap) mixed model design was used for this study with respect to the primary dependent variables of interest within the gap judgment tasks. Age group and gap judgment task type were both between-subjects factors, and cue condition was a within-subjects factor. Prior to the completion of the gap judgment task, participants completed a short battery of cognitive and personality measures.

Participants

Participants for the study were students recruited from WKU and the surrounding community. There were 36 younger adults (11 male, 25 female; ages 18-23 years, M = 19, SD = 1.3) and 38 older participants (17 male, 21 female; ages 65-78 years, M = 70.8, SD = 3.3) from the community; there were at least 15 participants per 2 (age group) x 2 (gap judgment task type) cell. The younger adult sample consisted of WKU students who signed-up via undergraduate participant pool and earned course credit for participating. The older adult sample consisted of older members of the community around the university. Sampling involved the use of voter registration records to contact participants from the community as well as the use of a participant database. Older adult participants from the community received a $20 gift card as compensation. Participants who were recruited from the community were screened using the Telephone Mini Mental Status

Exam (Folstein, Folstein, & McHugh, 1975; see Appendix A) to determine if they were at risk for mild cognitive impairment. Scores can vary from 0 to 27, and scores of 22 to 27 indicate normal functioning. All older participants performed within the range for normal functioning.

Cognitive and Personality Measures

A number of individual difference measures were administered for exploratory purposes and to characterize the younger and older adult samples. These measures included the Center for Epidemiological Studies Depression Scale, the BIS/BAS Scale, a brief 10-item Big Five personality inventory, and a short cognitive battery (processing speed and vocabulary). Additionally, demographics data and visual acuity data were also collected.

Center for epidemiological studies depression (CES-D) scale. For each of the 20 items in this depression screen, participants indicated the extent to which a statement characterized their recent emotional status (Radloff, 1977). Each statement was followed by a four-point rating scale: *Rarely or none of the time (less than one day)*, *Some or a little of the time (1-2 days)*, *Occasionally or a moderate amount of time (3-4 days)*, and *Most or all of the time (5-7 days)*. Total scores were calculated for each participant by summing their responses to each item. The internal consistency for this scale was .89. The questionnaire required approximately five minutes to complete (see Appendix B).

Behavior inhibition scale (BIS)/ behavior activation scale (BAS) (or BIS/BAS). Participants were asked to consider 24 different statements and indicate the extent to which they felt that each statement was generally true of them. Participants responded using a four-point rating scale: *1. Very true for me*, *2. Somewhat true for me*, *3. Somewhat false for me*, and 4*. Very false for me*. These statements (Carver & White, 1994) are meant to capture behavioral avoidance and behavioral activation. Total scores were calculated for each participant for each subcomponent (i.e., BIS and BAS) by summing their responses to each item. The internal consistency for BAS/Drive was .79, BAS/ Reward Responsiveness was .96, and BIS was .69. The questionnaire required five minutes to complete (see Appendix C).

View of self survey (big five inventory). This short personality inventory asks participants to indicate the extent to which 10 statements characterize their personality (Rammstedt & John, 2007). There were two items for each of the five Big Five dimensions of personality (Neuroticism, Extraversion, Agreeableness, Conscientiousness, and Openness to New Experiences). Participants responded using a five-point rating scale: *1. Disagree strongly, 2. Disagree a little, 3. Neither agree nor disagree, 4. Agree a little,* and *5. Agree strongly,* indicating how much they agreed with each of the 10 statements. Average scores were calculated for each dimension, and the test-retest reliability for this scale is generally .72 after six weeks. The inventory required approximately three minutes to complete (see Appendix D).

Advanced vocabulary test. The Advanced Test is a 36-item measure of verbal ability from the Kit of Factor Referenced Tests (Ekstrom, French, Harman, & Derman, 1976). For each item, participants chose the one response that has the same, or nearly the same meaning as the target word. The test required approximately eight minutes to complete.

Finding A's speed test. This is a test of the participant's ability to find the letter "a" in words. There are six pages of words. Each page has five columns of words, and each column has five words that contain the letter “a” (Ekstrom et al., 1976). Participants had two minutes to cross out as many words as they can that contain the letter “a”. The test required approximately two minutes and assesses processing speed.

Brief demographics questionnaire. Participants completed a 30-item questionnaire that asks them to describe their marital status, religious affiliation, age, gender, education level, subjective health, etc. This questionnaire required approximately five minutes to complete, and it was used to ensure that the sample is representative, reflecting the demographic characteristics of Warren County, Kentucky, and/or the United States (see Appendix E).

Snellen visual acuity test. Participants stood one meter away from a chart that has rows of letters of decreasing sizes. Participants are tested to see the smallest row that they can accurately read. Snellen acuity values were converted to log MAR (or minimum angle of resolution). This test required approximately two minutes to complete.

Gap detection task, including stimulus materials and apparatus. Performance was assessed using a spatial gap detection task and a temporal gap detection task (Bocanegra & Zeelenberg, 2011a). Approximately half of the participants completed the temporal gap detection task (young n = 18, old n = 16) and half completed the spatial gap detection task (young n = 14, old n = 15). For both tasks, participants viewed neutral and angry faces, which serve as a cue in advance of the gap detection task. Within both tasks, trials started with a fixation point that was presented for 1000 ms. During a trial of the spatial gap detection task (a sample trial of the spatial task is depicted in Figure 1), participants were presented with two identical face cues - either neutral or angry - equally spaced on the left and right of the display for 70 ms, followed by a single 0.8-degree

Landolt circle, presented at 4 degrees to the left or right of the fixation point, which had a small segment removed from it on “gap” trials for 100 ms. The Landolt circle contained a 4, 6, or 8 arcminute gap randomly presented on 120 trials, and no gap on the remaining 120 trials. Participants indicated whether or not they detected this spatial gap in one of the Landolt circles on each trial. The facial cues used on each trial consisted of two identical facial stimuli that measured 5.2 degrees in diameter. These were presented 8° and 10° to the left and right of the fixation point (for 8 young participants cues were spaced 10°, and 8° for 9 young participants; older adults were only presented with cues at 8° from the fixation). For older adults, the response screen duration was extended from 1.2 s to 2 s to allow them enough time to respond. This had no impact on the gap presentation portion of the trial.

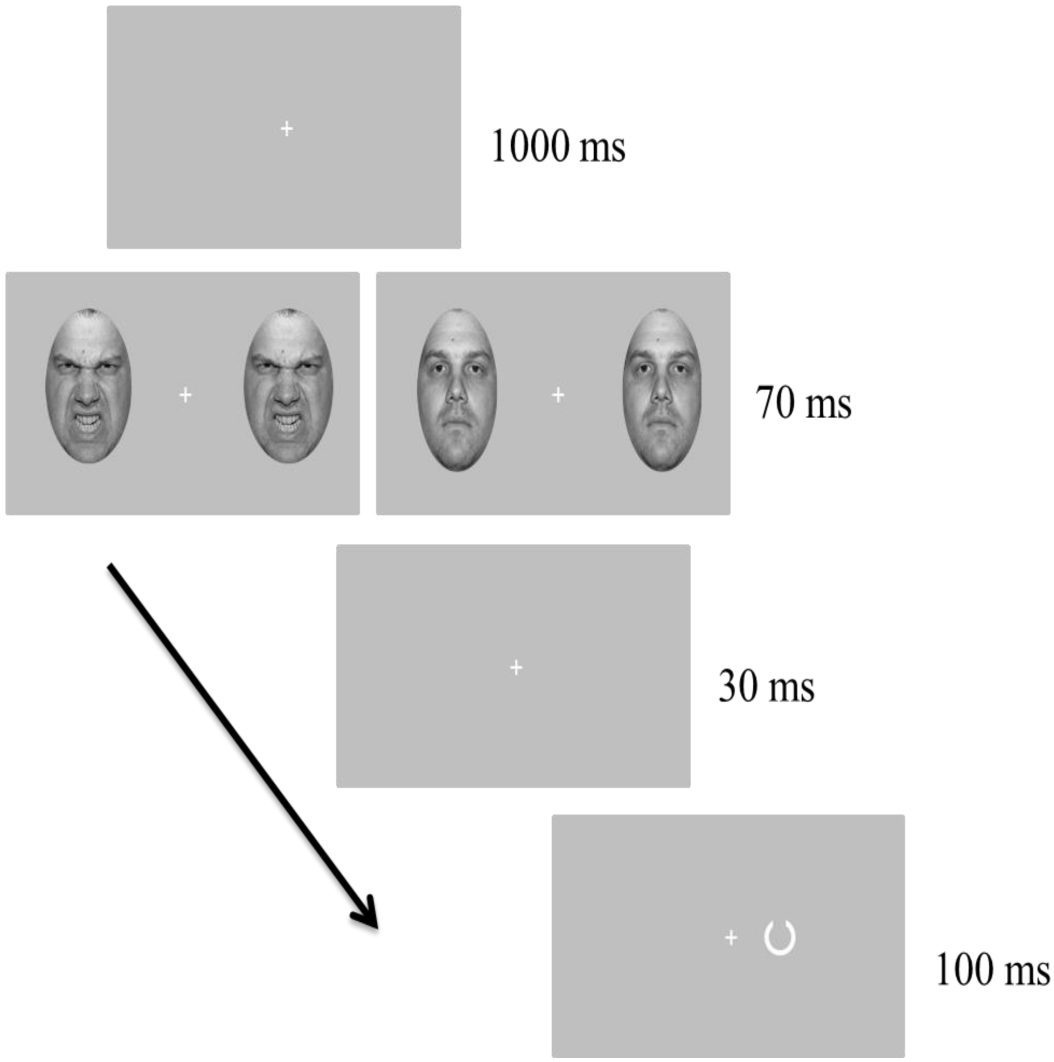

Figure 1. Sample of a trial from the spatial task. The sample shows the progression from start to finish.

During a trial of the temporal gap detection task (a sample trial of the temporal task is depicted in Figure 2), participants were also presented with two identical face cues – again, either neutral or angry - equally spaced (for 9 young participants cues were spaced 10°, and 8° for 10 young participants; older adults were only presented with cues at 8° from the fixation) on the left and right of the display for 70 ms. The cues were followed by a Landolt circle that appeared to flicker on trials with a temporal gap. On these trials, two consecutive Landolt circles appeared and disappeared with an offset to onset interval of 14, 28, or 42 ms. The overall stimulus duration was uniform across these three intervals. In order to achieve a 98 ms stimulus duration, the Landolt circles were present on the display before and after the gap for half of time that remained when one subtracts the gap duration (14, 28, or 42 ms) from 98 ms (i.e., 42, 35, or 28 ms). There were 120 trials with temporal gaps, 40 for each gap size, and 120 "no gap" trials that contained an intact Landolt circle for the range of time (80 ms) that would have otherwise been occupied by the flickering Landolt circle on the "gap" trials. For older adults, the response screen duration was extended from 1.2 s to 2 s to allow them enough time to respond. For both tasks, participants indicated whether or not they detected a gap, either spatial or temporal. All stimuli were presented on an ASUS 24-in. 1920 × 1080 full HD LCD monitor with a 144Hz rapid refresh rate, and participants indicated their responses by pressing a button on the computer keyboard to indicate the gap's presence or absence. For each task, participants completed a short block of practice trials followed by 240 main trials. Each task required roughly 20 minutes to complete. The dependent variable used to measure gap detection performance was d' values. These were calculated for each participant based on their hit and false alarm rates for each task (Macmillan & Creelman, 2005). Stimulus onset delays were tracked to ensure the fidelity of the manipulation.

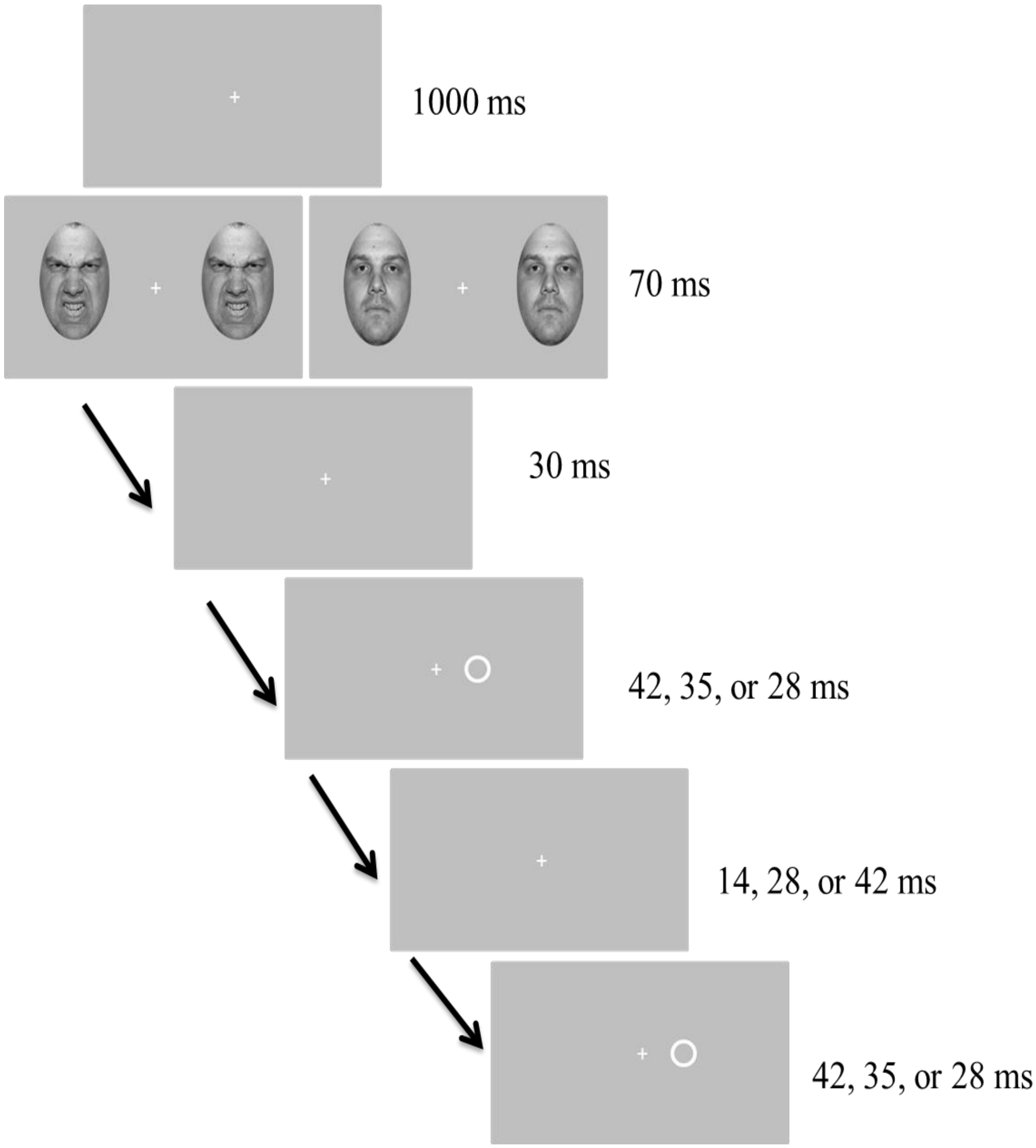

Figure 2. Sample of a trial from the temporal task. The sample shows the progression from start to finish.

The cues used in this task were individual photographs of faces portraying angry and neutral expressions from the MacBrain Face Stimulus Set (Tottenham et al., 2009).

There were five males and five females for a total of 10 individuals. After completing a gap detection task, participants completed an emotion judgment task and an emotion intensity rating task. The emotion judgment task consisted of 40 trials and took approximately five minutes to complete. Participants were asked to indicate if the expression found on the face was angry or neutral. The stimuli used for this task were identical to those used as cues in the gap detection task and were presented in an identical manner for 70 ms per trial. The emotion intensity rating task asked participants to rate the intensity of the emotion expressed on the face using a 4-point scale (1 = “no intensity”, 2 = “low intensity”, 3 = “moderate intensity”, & 4 = “high intensity”). The task consisted of 40 trials and required approximately five minutes to complete. In this task, the faces were allowed to remain on the display until an intensity response was registered by the participant.

Procedure

When participants arrived at their scheduled times, they were greeted and directed to a testing room within the lab. Participants were given an informed consent form that was approved (IRB #14-159) by Western Kentucky University’s Institution Review Board (IRB) and that outlined basic information regarding the study. Once consent was obtained, the experimenter explained the purpose of the study: to evaluate how quickly and accurately observers could detect a spatial gap or a timing gap in a circle stimulus.

Before the gap detection tasks, participants completed a set of personality cognitive abilities tasks. The tasks (in order) included the Center for Epidemiological Studies Depression scale, the BIS/BAS Scale, the View of Self Survey, the Advanced Vocabulary Test, and the Finding A’s Test. After completing these tasks, participants were randomly assigned to condition A (Spatial Gap condition) or condition B (Temporal Gap condition). Participants were seated approximately 57.3 cm away from the computer screen and instructed to keep their eyes on the fixation point throughout the entire test (i.e., 1 cm = 1^{o} on the display). The experimenter opened the corresponding stimulus presentation file on the computer; however, before completing the main experimental task, participants completed 52 practice trials to become familiar with the task and to make sure that the requirements of the experiment were clear. Participants were not exposed to the emotional cues during the practice trials. Only the smallest and largest gaps were included in the practice trials. For the main experimental gap detection task, participants were told that they would see faces that flashed on the screen before the circle appeared, and that the faces were just meant to cue them to expect the circle to appear shortly afterwards. They were instructed to respond to the presence/absence of the appropriate gap. After the gap detection task, participants completed the emotion judgment task, which was followed by the emotion intensity rating task. Participants were not give feedback during these two tasks. Afterwards, participants completed a demographics form and the visual acuity test. The experimenter then debriefed the participants and thanked them for their participation.

Chapter 3: Results

Participant Characteristics

An independent-samples t-test was conducted to compare individual difference measures in younger and older adults. The results of the analysis can be seen in Table 1.

Table 1

Mean difference of individual difference measures by age group

Measure	Older Adult		Younger Adult	
	Mean	SD	Mean	SD
CES-D*	1.28	.27	1.48	.45
BAS				
Drive*	2.53	.68	2.93	.63
Reward	3	.47	3.18	.32
BIS*	2.70	.56	3.03	.42
View of Self				
Openness	3.71	.88	3.84	.92
Conscientiousness*	4.46	.77	4.05	.71
Extraversion	3.28	.95	3.58	2.26
Agreeableness	4.03	.88	3.96	.92
Neuroticism*	2.53	1.03	3.04	.92
Vocabulary*	18.89	6.60	14.41	4.32
A's Test	23.92	6.96	23.95	4.65
Acuity*	.10	.09	.03	.07

*$p < .05$

Gap Detection Task Performance

For each gap detection task, participants' *d'* values were calculated from their hit rate and false alarm rates. Seven participants (two young, five old) were excluded for having excessive false alarm rates (i.e., FA > 25%) and two older adults were excluded for not following the directions, resulting in the following distribution of participants across between-subjects conditions:

Table 2

Participant Distribution

Age Group	Spatial Task	Temporal Task
Older Adults	15	16
Younger Adults	14	18

A 2 (age group: young/old) × 2 (task type: spatial gap/temporal gap) × 2 (cue condition: angry/neutral) × 3 (gap size) mixed-model ANOVA was performed on the participants' gap detection task *d*' values, in which age group and task type were between-subjects factors, and cue condition and gap size were within-subjects factors. Post hoc tests were performed using Fisher's Least Significant Difference tests. The analysis revealed a significant main effect of gap size, $F(1, 59) = 19.94$, $p < .001$, $\eta_p^2 = .25$, indicating that the smallest gap was more difficult to detect ($M = 2.12$, $SE = .10$) than the medium-size ($M = 2.32$, $SE = .11$) and largest ($M = 2.40$, $SE = .11$) gaps. There was a significant interaction between cue condition and age group, $F(1, 59) = 6.59$, $p = .013$, $\eta_p^2 = .10$, such that younger adults were better at detecting spatial gaps when they were preceded by angry cues than when they were preceded by neutral cues, whereas for older adults there was not a significant difference between angry and neutral cues on either task.. The results are displayed in Figure 3.

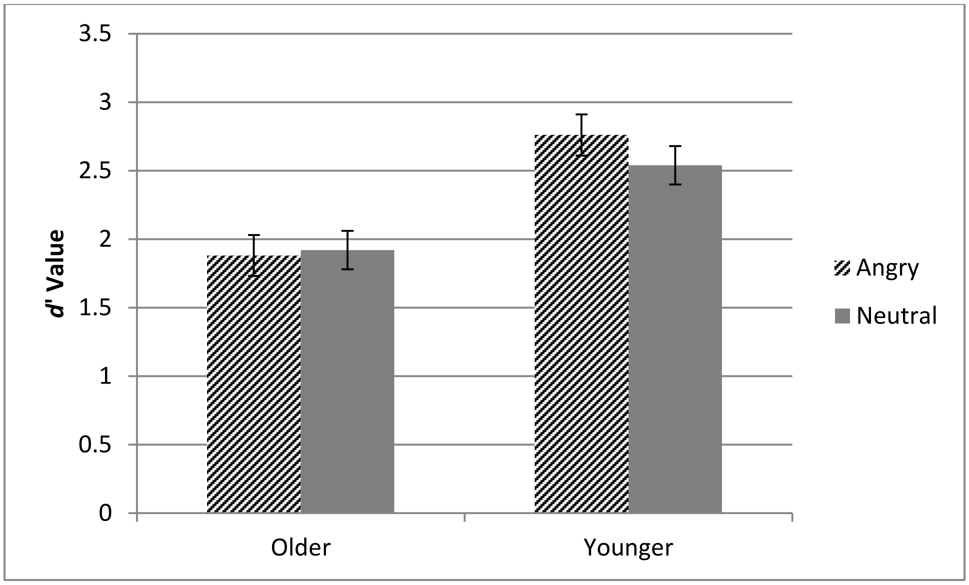

Figure 3. Cue Condition × Age Group Interaction based on participant d’ values (error bars indicate *SE*).

There was a significant interaction between cue condition and task type, $F(1, 59) = 5.35$, $p = .024$, $\eta_p^2 = .083$, such that, in the spatial task, gaps preceded by angry cues were better detected than gaps preceded by neutral cues. However, in the temporal task, there was no difference in gap detection performance when gaps were preceded by neutral cues or angry cues. The results are displayed in Figure 4.

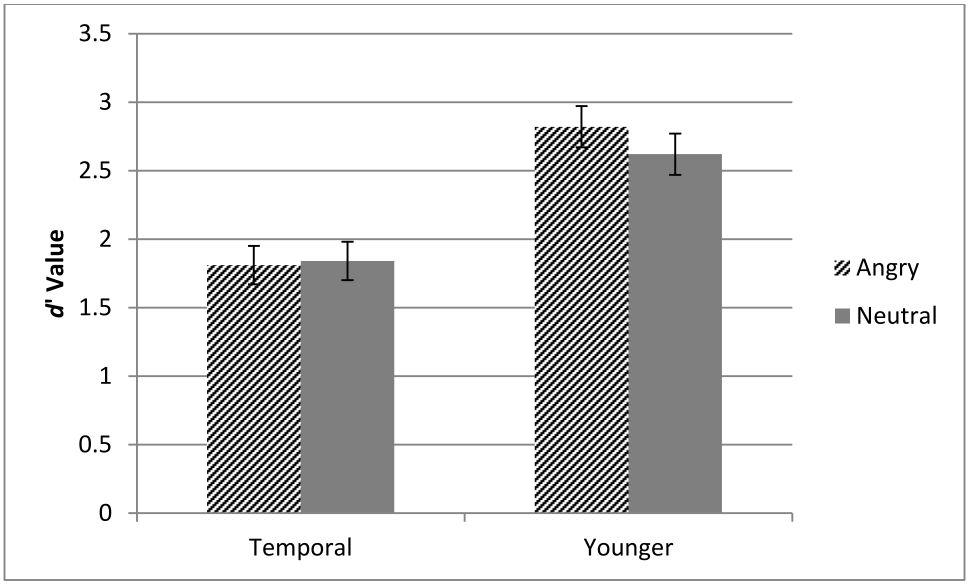

Figure 4. Cue Condition × Task Type Interaction based on participant d’ values (error bars indicate *SE*).

There was also a significant interaction between gap size and age group, $F(1, 59) = 9.59$, $p = .003$, $\eta_p^2 = .14$, such that older adults were best at detecting the large gaps than the medium-sized gaps, and finally the smallest gaps for both tasks, whereas younger adults’ performance in detecting large and medium-sized gaps did not differ but was better than their performance in detecting the smallest gap on the temporal task, however, there was no difference for the gap sizes on the spatial task . The results are displayed in Figure 5.

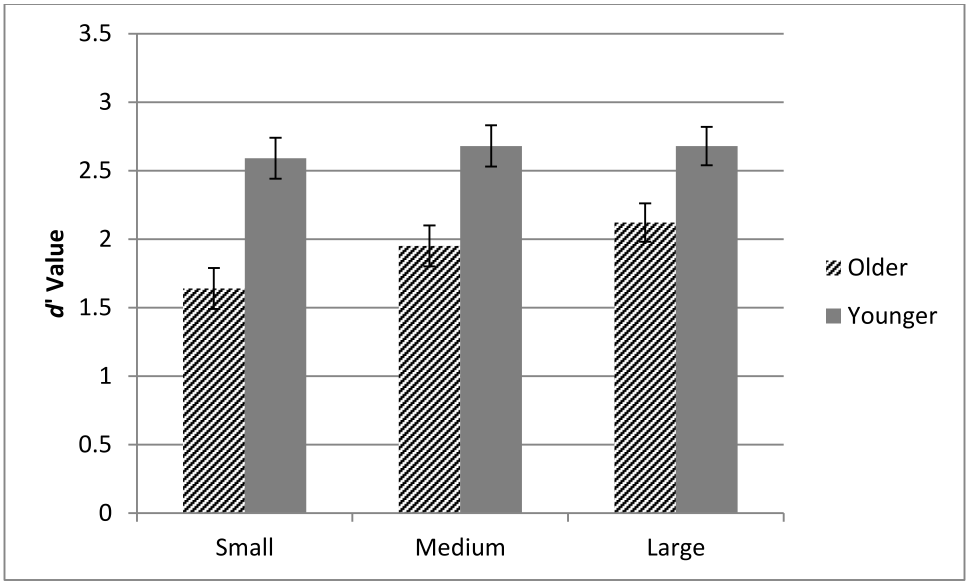

Figure 5. Gap Size × Age Group Interaction based on participant d' values (error bars indicate *SE*).

Finally, all of these effects were qualified by a significant three-way interaction between gap size, age group, and task type, $F(1, 59) = 5.89$, $p = .018$, $\eta^2 = .09$. In the temporal task, younger adults had similar *d*' values for the medium and large size gaps, but worse performance for the smallest gap. Older adults' performance on the temporal gap detection task, however, increased as the gap size increased from one level to the next. On the spatial task, younger adults' ability to detect the gap did not vary based on the size of the gap, but older adults' performance again increased as the size of the gap increased. The results are displayed in Figure 6.

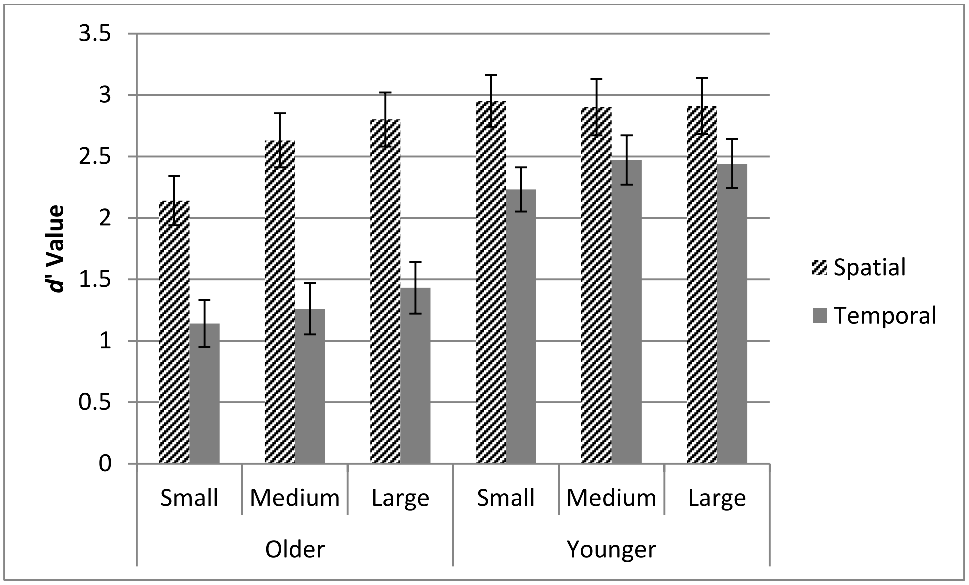

Figure 6. Gap Size × Age Group × Task Type Interaction based on participant d' values (error bars indicate *SE*).

Emotion Recognition Task Performance

A 2 (age group: young/old) × 2 (emotion: angry/neutral) mixed-model ANOVA was performed on the participants' emotion recognition scores for the emotion judgment task. The analysis did not reveal any significant findings. There was no difference between younger and older adults' performance on the emotion recognition task. The results are displayed in Figure 7.

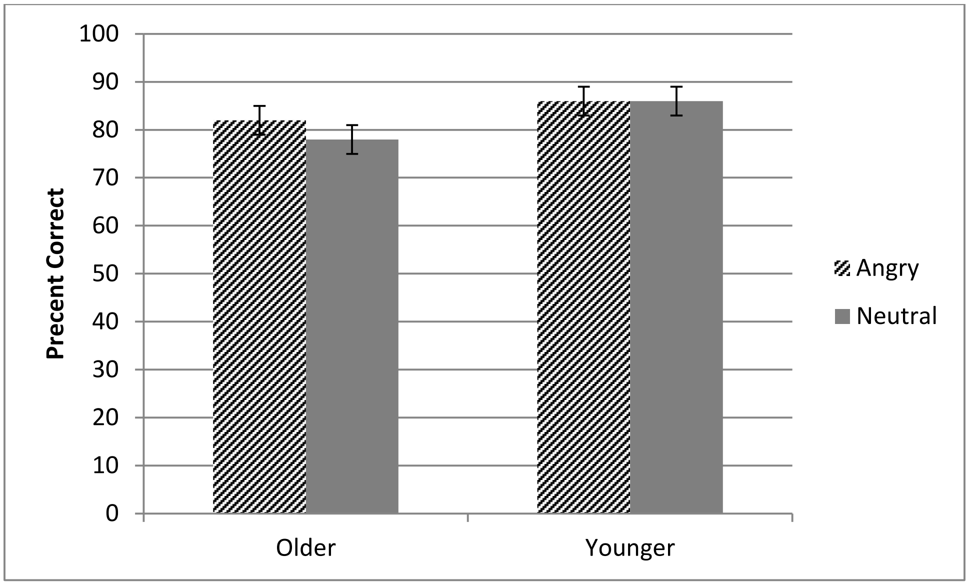

Figure 7. Emotion Recognition Percent Correct (error bars indicate *SE*).

A 2 (age group: young/old) × 2 (emotion: angry/neutral) mixed-model ANOVA was performed on the participants' values for the emotion intensity rating task. The analysis revealed a main effect of emotion, $F(1, 61) = 3013.02$, $p < .001$, $\eta_p^2 = .98$, indicating that angry ($M = 3.68$, $SE = .04$) cues were rated more intense than neutral ($M = 1.30$, $SE = .04$) cues. There was also a main effect of age group, $F(1, 61) = 5.14$, $p = .027$, $\eta_p^2 = .08$. On average, older adults ($M = 2.55$, $SE = .04$) had higher intensity ratings than younger adults ($M = 2.43$, $SE = .04$) as a group, but the effect is not seen when looking at differences between younger and older adults' ratings for individual emotions.

Chapter 4: Discussion

The goal of this study was to replicate Bocanegra and Zeelenberg's (2011a) emotion-related enhancement to temporal gap detection using a younger adult sample while also extending these findings to an older adult sample. In their work, Bocanegra and Zeelenberg (2011a) found that when participants were presented with a fear-inducing stimulus milliseconds before the presentation of a gap detection task, the stimulus impaired their participants' ability to detect fine-grained spatial details, but enhanced temporal vision. In the current study, these findings were not replicated within the younger adult sample. Younger adults displayed better spatial gap detection performance but not better temporal gap detection performance following angry facial cues than following neutral facial cues. Although inconsistent with Bocanegra and Zeelenberg's earlier work, the current study's findings are partly consistent with those of other studies that examine the impact of emotional cues on spatiotemporal vision in younger adults. For older adults, the emotionality of the facial cue presented prior to each gap judgment had no impact whatsoever on older adults' spatial or temporal gap detection performance. Given the absence of emotion-related effects in this study, older adults' performance was partly consistent with predictions stemming from the Aging Brain Model and the possibility that advancing age leads to either a decline in amygdala functioning or a decline in the connections that link the amygdala to visual cortices.

Replication Attempt: Younger Adult Sample and Emotion's Impact on Gap Detection

In the current study, it was expected that younger adults' temporal gap detection performance would be enhanced on trials in which angry cues were presented before the gap judgment. Bocanegra and Zeelenberg (2011a) suggest that this enhancement involves a trade-off between magnocellular and parvocellular pathways that ultimately facilitates the processing of the fear-inducing stimulus. The current study failed to replicate their findings, as younger adults' performance on the temporal gap detection task did not differ as a function of the emotional cue presented before each trial. Moreover, although Bocangera and Zeelenberg (2011a) found that fearful cues impaired spatial gap detection performance, the current study found angry cues enhanced younger adults' spatial gap detection performance relative to the neutral cues. Again, Bocanegra and Zeelenberg suggest that a temporal judgment enhancement and a spatial judgment decrement emerge as the result of an adaptive visual bias that enhances the detection of fast temporal features at the expense of spatial detail early on in visual processing. The results of the current study suggest that this possibility is not ubiquitous, as the same enhancement was not observed for a younger adult sample.

In addition to Bocanegra and Zeelenberg's (2011b) research, other studies have examined the impact that emotional cues have on subsequent visual processing. For instance, Phelps and colleagues found that fearful cues enhanced contrast sensitivity to Gabor patches presented immediately afterwards, suggesting that emotion facilitates judgments for spatial details of subsequent stimuli (Phelps et al., 2006). Like Bocanegra and Zeelenberg (2011b), Phelps and colleagues suggested that the enhanced performance occurred due to amygdala-related input to the visual system that potentiated the judgments in their task. Öhman et al. (2001) found the participants were faster at detecting a face within a crowd of other faces if the facial expression was threatening. They also suggest that negative emotional features capture more attention, and that attention guides our conscious awareness by driving a search through out environment for threatening features. Likewise, amygdala activation is greater in response to negative emotional stimuli, and this activation is associated with more attention being directed toward negative emotional information (Hariri et al., 2002).

The current study demonstrates greater accuracy for spatial gap detection when the targets were preceded by an angry facial cue than when preceded by a neutral facial cue. Prior research demonstrates an enhancement for performance on a temporal gap detection task instead (Bocanegra & Zeelenberg, 2011a). However, the younger adults' data from the current study support Phelps and colleagues' (2006) aforementioned findings. In their research, greater accuracy emerged for a spatial resolution judgment that followed a negative emotional stimulus relative to when that judgment followed a neutral stimulus. When taken together, all of these studies suggest that emotion facilitates early visual processing. For all of these findings, an emotion-related enhancement is the common outcome; unclear, however, is the exact mechanism by which emotional information generates this outcome.

Negative Emotion Fails to Impact Older Adults' Gap Detection Performance

In the current study, angry and neutral emotional cues had no impact on older adults' gap detection performance. Although younger and older adults were no different in their ability to perceive emotion found in the fleeting emotional cues and despite the trend for older adults to rate the angry cues as more intense than younger adults, the cues failed to elicit the same outcome in an older adult sample that they elicited in the younger adult sample. With respect to the two competing theories – socioemotional selectivity theory (SST) and the Aging Brain Model (ABM) – these findings lend more support to one theory than the other. Remember that, according to SST, older adults consciously make a decision to not focus on negative emotional stimuli if given time to consciously process them. However, if stimuli are presented for an extremely short period of time, as they are in the current study, older adults should be unable to consciously make a decision to ignore the cue and show a gap detection decrement. With respect to ABM, advancing age should weaken the connections between the amygdala and the visual system, reducing any possible effects that emotion might have on older adults' gap detection ability. The null findings from the older adult sample in the current study are more consistent with the predictions of ABM than with those of SST.

In the current study, the emotional cues had no effect on older adults' gap detection performance in either task. If there would have been an effect of emotion it should have been evident in the spatial task if younger and older adults' visual systems are supposed to operate similarly. These results support the idea that amygdala activation for negative stimuli declines with age (Kisley, Wood, & Burrows, 2007). Previous research has indicated that, if given time, older adults could use cognitive control to divert their focus away from negative stimuli. However, in the current study, there is not enough time for older adults to use cognitive control. If there had been enough time, the older adults' data might have demonstrated better gap detection performance when the targets were preceded by neutral cues. The current study's null finding for the older adult sample suggest that, relative to the amygdala of the typical younger adult, the amygdala of the typical older adult might be less sensitive to negative emotional cues or might contribute less to gap detection if it is sensitive to negative emotional cues.

Conclusions

Although this study was unable to replicate the findings of Bocanegra and Zeelenberg (2011a), the current study's findings do show some consistency with prior research. With respect to younger adults, angry cues enhanced spatial gap detection, supporting prior research demonstrating that arousing emotional stimuli can enhance visual processing of subsequent stimuli. This enhancement can possibly be linked to the functioning of the amygdala and its ability to rapidly communicate emotion-related inputs to the visual system. For older adults, despite showing superior gap detection performance (e.g., *d'* = 1.6 – 2.0+), no emotion-related enhancement was observed on either gap detection task. These findings suggest that the rapid neural stream of information that supports younger adults' visual processing when emotional stimuli are present may be weakened with advancing age. This interpretation of the data is consistent with the ABM. However, it is important to note that, when asked to consciously deliberate over the emotional stimuli themselves, age differences in emotion recognition accuracy and emotion intensity ratings were non-significant. Overall, it is not clear how the absence of any spatiotemporal benefit of emotional cues on subsequent stimulus processing impacts older adults' everyday lives. Additional research is needed to replicate this finding and to improve our understanding of its implications. Moreover, if the ABM is accurate and the loss of connections between the amygdala and cortical regions reduces older adults' reactivity to negative information, then future research is needed to uncover why positive emotion processing might be spared and whether or not the amygdala is also involved in the positivity-related enhancements often noted in the aging literature.

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APPENDIX A
TELEPHONE SCREENING PROTOCOL

Instructions for Interviewer: Read only those parts in bold to the respondent.

I will be asking you several questions over the course of this telephone interview. All of the information that you give me will remain confidential. No one other than the individuals working in the Lifespan Social Cognition Laboratory will see your answers to these questions. You may decline to answer any of the questions and you may stop this interview at any time. Do you have any questions?

First I would like to get some basic information about you.

Name: ____

Address: ____

____

Phone: ____

Age: _____________ Date of Birth: _____________________________

Level of Education: ____

How did you find out about our research? _________________________

____

____

Other researchers at the Center for Research on Aging are recruiting participants for different studies.

Can we give them your name? __________

If a respondent asks to stop the interview at any point during the screening, ask if they would be willing to answer questions in a personal interview with the research assistant.

Mini Mental State Exam (TMMSE)

Now I am going to ask you some questions that will allow me to determine whether you meet the requirements for participation in this research. Again, all of the information that you give me will remain confidential. You may decline to answer any of the questions and you may stop this interview at any time. Do you have any questions?

ORIENTATION

What is the date today? (See answer sheet for additional orientation questions.) Ask the respondent for any omitted parts. Give one point for each correct answer.

REGISTRATION

May I test your memory? Then say the names of three unrelated objects, clearly and slowly, about one second for each: **Apple, lamp, tower.** After you have said all three, ask the respondent to repeat them. This first repetition determines the score but keep saying them until the respondent can repeat all three; give up to six trials. If the respondent does not eventually learn all three words, recall cannot be meaningfully tested.

ATTENTION & CALCULATION

Now begin with 100 and count backward by 7. Stop the respondent after five subtractions (93, 86, 79, 72, 65). Score the total number of correct answers.

If the respondent cannot or will not perform this task, ask: **Please spell the word "world" backwards.** The score is the number of letters in correct order; e.g. dlrow = 5.

RECALL

Can you tell me the three words that I asked you to remember?

LANGUAGE

Please repeat the following: No ifs, ands, or buts.

Tell me, what is the thing called that you are speaking into as you talk to me?

If the respondent does not meet the requirements for participation, say: **Thank you very much for your time. Your name will be entered into our files.** Enter name, final TMMSE score into the database and check the NO CALL BACK box.

If the respondent does meet requirements continue on to the Medical History Questionnaire.

ORIENTATION (total pts. 8)	**Response**	**Score**

What is the date?	________________	__________ (1)
What is the day?	________________	__________ (1)
What is the month?	________________	__________ (1)
What is the year?	________________	__________ (1)
What is the season?	________________	__________ (1)
Where are we:		
State	________________	__________ (1)
County	________________	__________ (1)
Town	________________	__________ (1)
REGISTRATION (total pts. 3)		
	________________	__________ (1)
	________________	__________ (1)
	________________	__________ (1)
ATTENTION & CALCULATION (total pts. 5)		
	________________	__________ (1)
	________________	__________ (1)
	________________	__________ (1)
	________________	__________ (1)
	________________	__________ (1)
RECALL (total pts. 3)		
	________________	__________ (1)
	________________	__________ (1)
	________________	__________ (1)
LANGUAGE (total pts. 2)		
	________________	__________ (1)
	________________	__________ (1)
Total Score		______________
(at least 17 pts. required)		

Medical History Questionnaire

Read the following instructions to the respondent: **Now I am going to ask you some questions about your medical history. Again, if you do not feel comfortable answering any of these questions, you may refuse at any time. All of the information that you give me will remain confidential. Do you have any questions?**

> *(If the respondent does not agree to answer questions ask:* ***Would you be willing to answer questions about your medical history in a personal interview with a research assistant?*** *If the respondent says yes, say:* ***Thank you for your time. A research associate from the Lifespan Social Cognition Laboratory will call you to schedule the interview.*****)**

If the respondent agrees to answer questions say: **For the next few questions you may answer yes or no. Do you have…**

Yes	No	
____	____	High Blood pressure
____	____	Stroke
		If yes, when? ____________
		Do you have impairment from the stroke? _______ ____
____	____	Heart disease
____	____	Kidney disease
____	____	Neurological disease
____	____	Head Injury
		Of yes, was there loss of consciousness? ______
		For how long? ___________________________
____	____	Other (specify) ________________________________
____	____	Have you received treatment for psychological problems in the past 2 years (e.g. depression, anxiety)
____	____	Have you had any difficulty sleeping in the past 2 weeks?
____	____	Have you experienced any change in your sleeping patterns within the last 3 months?
____	____	Have you experienced any change in you eating patterns within the last 3 months?
____	____	Have you experienced any major change in your weight within the past 3 months?

____	____	Have you had any difficulty with unexplained tiredness Within the past 3 months?
____	____	Have you had any difficulty with unexplained crying or Irritability within the past 3 months?
____	____	Do you use tobacco products?

What product? ____________________________

How much per day? ________________________

If the respondent does not meet the requirements, say: **Thank you very much for your time.**
Your name will be entered into our files. Enter name, final TMMSE score and medical history
into database and check the NO CALL BACK box.

If the respondent does meet the requirements, say: **Finally, are you currently taking any**
medications? This includes prescription drugs, vitamins, aspiring, antacids, etc. Please
indicate all recreational drugs and alcoholic beverages. This information will remain
confidential.

Name of Medication	Amount of use (regular or occasional)
______________________	______________________
______________________	______________________
______________________	______________________
______________________	______________________
______________________	______________________
______________________	______________________
______________________	______________________
______________________	______________________
______________________	______________________

If the respondent does not meet the requirements, say: **Thank you very much for your time. Your name will be entered into our files.** Enter name, final TMMSE score, medical history, and medications into database and check the NO CALL BACK box.

APPENDIX B
Feelings Scale

<u>Instructions</u>: In this booklet, there are statements about the way that most people feel at one time or another. There is no such thing as a "right" or "wrong" answer because all people are different. All you have to do is answer the statements according to how you have felt during the past week. Don't answer according to how you USUALLY feel, but rather how you have felt DURING THE PAST WEEK. Each statement is followed by four choices. ***<u>Circle</u>*** the letter corresponding to your choice. Mark ONLY ONE letter for each statement. For example:

During the past week, I was happy.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

In the example, you could, of course, choose any ONE of the answers. If you felt really happy, you would circle “d”. If you felt very unhappy, you would circle “a”. The “b” and “c” answers give you middle choices. Keep these following points in mind.
1. Don't spend too much time thinking about your answer. Give the 1st natural answer that comes to you.
2. Do your best to answer EVERY question, even if it doesn't seem to apply to you very well.
3. Answer as honestly as you can. Please do not mark something because it seems like "the right thing to say".

---

1. During the past week, I was bothered by things that don’t usually bother me.
   a. Rarely or none of the time (less than one day)
   b. Some or a little of the time (1 - 2 days)
   c. Occasionally or a moderate amount of time (3 - 4 days)
   d. Most or all of the time (5 - 7 days)

2. During the past week, I did not feel like eating. My appetite was poor.
   a. Rarely or none of the time (less than one day)
   b. Some or a little of the time (1 - 2 days)
   c. Occasionally or a moderate amount of time (3 - 4 days)
   d. Most or all of the time (5 - 7 days)

3. During the past week, I felt that I could not shake off the blues even with help from my family or friends.
   a. Rarely or none of the time (less than one day)
   b. Some or a little of the time (1 - 2 days)
   c. Occasionally or a moderate amount of time (3 - 4 days)

d. Most or all of the time (5 - 7 days)

4. During the past week, I felt that I was just as good as other people.
    a. Rarely or none of the time (less than one day)
    b. Some or a little of the time (1 - 2 days)
    c. Occasionally or a moderate amount of time (3 - 4 days)
    d. Most or all of the time (5 - 7 days)

5. During the past week, I had trouble keeping my mind on what I was doing.
    a. Rarely or none of the time (less than one day)
    b. Some or a little of the time (1 - 2 days)
    c. Occasionally or a moderate amount of time (3 - 4 days)
    d. Most or all of the time (5 - 7 days)

6. During the past week, I felt depressed.
    a. Rarely or none of the time (less than one day)
    b. Some or a little of the time (1 - 2 days)
    c. Occasionally or a moderate amount of time (3 - 4 days)
    d. Most or all of the time (5 - 7 days)

7. During the past week, I felt that everything I did was an effort.
    a. Rarely or none of the time (less than one day)
    b. Some or a little of the time (1 - 2 days)
    c. Occasionally or a moderate amount of time (3 - 4 days)
    d. Most or all of the time (5 - 7 days)

8. During the past week, I felt hopeful about the future.
    a. Rarely or none of the time (less than one day)
    b. Some or a little of the time (1 - 2 days)
    c. Occasionally or a moderate amount of time (3 - 4 days)
    d. Most or all of the time (5 - 7 days)

9. During the past week, I thought my life had been a failure.
    a. Rarely or none of the time (less than one day)
    b. Some or a little of the time (1 - 2 days)
    c. Occasionally or a moderate amount of time (3 - 4 days)
    d. Most or all of the time (5 - 7 days)

10. During the past week, I felt fearful.
    a. Rarely or none of the time (less than one day)
    b. Some or a little of the time (1 - 2 days)
    c. Occasionally or a moderate amount of time (3 - 4 days)
    d. Most or all of the time (5 - 7 days)

11. During the past week, my sleep was restless.
    a. Rarely or none of the time (less than one day)

b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

12. During the past week, I was happy.
a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

13. During the past week, I talked less than usual.
a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

14. During the past week, I felt lonely.
a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

15. During the past week, people were unfriendly.
a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

16. During the past week, I enjoyed life.
a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

17. During the past week, I had crying spells.
a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

18. During the past week, I felt sad.
a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)

c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

19. During the past week, I felt that people dislike me.
    a. Rarely or none of the time (less than one day)
    b. Some or a little of the time (1 - 2 days)
    c. Occasionally or a moderate amount of time (3 - 4 days)
    d. Most or all of the time (5 - 7 days)

20. During the past week, I could not get "going".
    a. Rarely or none of the time (less than one day)
    b. Some or a little of the time (1 - 2 days)
    c. Occasionally or a moderate amount of time (3 - 4 days)
    d. Most or all of the time (5 - 7 days)

APPENDIX C
BIS/BAS

<u>Instructions</u>: Each item of this questionnaire is a statement that a person may either agree with or disagree with. For each item, indicate how much you agree or disagree with what the item says. Please respond to all the items; do not leave any blank. Choose only one response to each statement. Please be as accurate and honest as you can be. Respond to each item as if it were the only item. That is, don't worry about being "consistent" in your responses. Choose from the following four response options:

1 = very true for me
2 = somewhat true for me
3 = somewhat false for me
4 = very false for me

_____ 1. A person's family is the most important thing in life.

_____ 2. Even if something bad is about to happen to me, I rarely experience fear or nervousness.

_____ 3. I go out of my way to get things I want.

_____ 4. When I'm doing well at something I love to keep at it.

_____ 5. I'm always willing to try something new if I think it will be fun.

_____ 6. How I dress is important to me.

_____ 7. When I get something I want, I feel excited and energized.

_____ 8. Criticism or scolding hurts me quite a bit.

_____ 9. When I want something I usually go all-out to get it.

_____ 10. I will often do things for no other reason than that they might be fun.

_____ 11. It's hard for me to find the time to do things such as get a haircut.

_____ 12. If I see a chance to get something I want I move on it right away.

_____ 13. I feel pretty worried or upset when I think or know somebody is angry at me.

_____ 14. When I see an opportunity for something I like I get excited right away.

_____ 15. I often act on the spur of the moment.

_____ 16. If I think something unpleasant is going to happen I usually get pretty "worked up."

_____ 17. I often wonder why people act the way they do.

_____ 18. When good things happen to me, it affects me strongly.

_____ 19. I feel worried when I think I have done poorly at something important.

_____ 20. I crave excitement and new sensations.

_____ 21. When I go after something I use a "no holds barred" approach.

_____ 22. I have very few fears compared to my friends.

_____ 23. It would excite me to win a contest.

_____ 24. I worry about making mistakes.

APPENDIX D
View of Self (VoS) Survey

<u>Instructions</u>: For this survey, we are interested in knowing how well each of the following statements describes your personality. Using the rating scale (1 to 5) provided below, please indicate how much you agree with each of the following statements. Please indicate your response by ***writing a number in the space next to each statement***.

1	2	3	4	5
Disagree strongly	**Disagree a little**	**Neither agree nor disagree**	**Agree a little**	**Agree strongly**

______ 1. I see myself as someone who is reserved.

______ 2. I see myself as someone who is generally trusting.

______ 3. I see myself as someone who tends to be lazy.

______ 4. I see myself as someone who is relaxed, handles stress well.

______ 5. I see myself as someone who has few artistic interests.

______ 6. I see myself as someone who is outgoing, sociable.

______ 7. I see myself as someone who tends to find fault with others.

______ 8. I see myself as someone who does a thorough job.

______ 9. I see myself as someone who gets nervous easily.

______ 10. I see myself as someone who has an active imagination.

APPENDIX E
Lab Demographics Questionnaire

<u>Instructions</u>: The items in this questionnaire ask you for personal information that we can use to get a sense for how similar our group of volunteers is to those who participate in research at other institutions in the United States. All information that we collect from individuals will not be linked back to their identities. However, if you are uncomfortable providing a response for any of the following items, please do not respond to them. For the remaining items, please ***fill in the blank spaces*** or ***circle the response*** which best describes you.

Handedness: LEFT or RIGHT

Vision: 20 / _____

1. **Please indicate your gender:** 1. Female 2. Male
2. **Please indicate your marital status:** 1. Single
   2. Married
   3. Domestic Partnership
   4. Divorced
   5. Widowed
   6. Other (specify) ____________________
3. **Please indicate how many children you have raised or are currently raising.** _____

4. **Date of birth:** _____/_____/_____ **and current age:** ___________ years

5. **Do you consider yourself to be Hispanic or Latino?** 1. YES 2. NO

6. **Please indicate your racial background:**
   1. American Indian/ Alaska Native
   2. Asian
   3. Native Hawaiian or Other Pacific Islander
   4. Black or African American
   5. Caucasian
   6. More than one race (specify) ___________________________
   7. Other (specify) ________________________________

6. **Is English your native language?** 1. Yes 2. No
7. **Please indicate your religious faith:** 1. Christian (Protestant or Catholic)
   2. Jewish
   3. Hindu
   4. Muslim
   5. Buddhist
   6. None (e.g., atheist)
   7. Other (specify) _______________________

8. Are you a student? 1. Yes - full time 2. Yes - part time 3. No

9. If you are a student, please indicate your academic major:

1. Arts (specify) ______________________________
2. Business (specify) ______________________________
3. Engineering (specify) ______________________________
4. Humanities (specify) ______________________________
5. Science (specify) ______________________________
6. Health (specify) ______________________________
7. Education (specify) ______________________________
8. Other (specify) ______________________________

10. What is your highest level of formal education (circle the highest level <u>completed</u>):

- **A.** Less than 12 years (How many of years completed? __________ years)
- **B.** GED (Age when you completed your GED: ________)
- **C.** High school diploma
- **D.** Technical/ Vocational/ Trade school diploma or certificate
- **E.** College Freshman
- **F.** College Sophomore
- **G.** College Junior
- **H.** Associate's Degree
- **I.** Bachelor's degree
- **J.** Master's degree
- **K.** J.D., M.D., or Ph.D.

11. Are you presently employed: 1. Yes - full time 2. Yes - part time 3. No

12. Are you presently retired? 1. Yes 2. No

13. If you are currently or have recently been employed, what field is your job in?

____

14. If you are currently or have recently been employed, please describe the duties of your job?

____

____

15. In the past 5 years, have you engaged in volunteer activities to assist or instruct young adults (i.e., individuals aged 18-30)? 1. Yes 2. No

16. To what extent do you interact with young adults throughout the course of a typical week (including time spent at work, in classes, and/or during volunteer or extracurricular activities)?

1. Rarely or none of the time (less than one day)

2. Some or a little of the time (1 - 2 days)
3. Occasionally or a moderate amount of time (3 - 4 days)
4. Most or all of the time (5 - 7 days)

17. How would you rate your overall health at the present time? (please circle one rating)

1. Poor 2. Fair 3. Good 4. Very Good 5. Excellent

18. How much do health problems stand in your way of doing things that you want to do? (please circle one rating) 1. Not at all 2. A little 3. Moderately 4. Quite a bit 5. A great deal

19. Are you presently seeking psychological or psychiatric consultation and/or receiving therapy?

1. Yes 2. No

If <u>yes</u>…

a. Are you currently being treated for depression? 1. Yes 2. No

b. Are you currently being treated for excessive anxiety or nervousness? 1.Yes 2.No

20. Do you currently have any noticeable difficulty with vision for which correction, such as eyeglasses, has <u>NOT</u> been made? 1. Yes 2. No

29. Do you currently have any noticeable difficulty with hearing for which a correction, such as a hearing aide, has <u>NOT</u> been made? 1. Yes 2. No

30. Do you currently have any difficulty with writing? 1. Yes 2. No