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AROUSAL OR RELEVANCE? APPLYING A DISCRETE EMOTION PERSPECTIVE
TO AGING AND AFFECT REGULATION

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At the

CLEVELAND STATE UNIVERSITY

May 2019

We hereby approve this thesis

For

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ABSTRACT

While research in the psychology of human aging suggests that older adults are quite adept at managing negative affect, emotion regulation efficacy may depend on the discrete emotion elicited. For instance, prior research suggests older adults are more effective at dealing with emotional states that are more age-relevant/useful and lower in intensity (i.e., sadness) relative to less relevant/useful or more intense (i.e., anger). The goal of the present study was to probe this discrete emotions perspective further by addressing the relevance/intensity distinction within a broader set of negative affective states (i.e., fear and disgust, along with anger and sadness). Results revealed that participants reported relatively high levels of the intended emotion for each video, while also demonstrating significant affective recovery after the attentional refocusing task. Age differences in sadness and anger reactivity were observed with older adults reporting higher subjective reactivity relative to younger adults, with comparable recovery levels. Results from the physiological analyses did not reveal significant age differences in reactivity and recovery profiles. We discuss how the present results, at least in terms of participants' subjective emotional experiences, suggest potential expansions to the discrete emotions approach for affective processing and regulation throughout the adult lifespan.

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CHAPTER I

INTRODUCTION

Old age is often assumed to be a period of overall decline (Carstensen, et. al, 2011). It is the time in life that is most notably known for memory issues, increased health problems, and physical limitations (Schiebe & Carstensen, 2010). However, these presumed age-related declines are not true for all aspects of life. Many studies have observed improvements to emotional well-being across the adult lifespan. With advanced age, emotional stability becomes more prevalent, and the ability to regulate emotions improves (Carstensen et al., 2011; Carstensen, Pasupathi, Mayr, & Nesselroade, 2000). While there is a large body of research on how emotion regulation is crucial for late-life well being, there are still some aspects of this literature that need to be examined. Emotional well-being research tends to focus on simple valence dimensions: “pleasant” vs. “unpleasant.” However, specific emotions within the “positive” and “negative” spheres differ in various ways, particularly in terms of when certain positive and/or negative states are desirable, adaptive, or attainable within specific contexts. Thus, in order to gain a more nuanced understanding of emotion regulation in old age, it is important to take a more discrete emotions perspective. Exploring emotions across a motivational spectrum, rather than solely through a positive or negative dichotomy,

allows for a more comprehensive assessment of emotion dynamics across adulthood and old age. This spectrum viewpoint complements other lifespan theories, and in turn allows for better interpretation of age-related emotional processing and regulation trajectories (Kunzmann, Kappes, & Wrosch, 2014; Kunzmann, Rohr, Wieck, Kappes & Wrosch, 2017).

Healthy Emotional Functioning in Old Age

Many studies have examined age-related changes in emotion processing across adulthood. Some earlier studies argued that heightened emotional control in old age was the result of decreases in emotional experience and expressivity, namely in response to negative affect elicitors, in comparison to younger adults (Lawton, Kleban, Rajagopal & Dean, 1992; Gross et al., 1997). However, other studies have noted that older adults report experiencing a wide range of affective states (Carstensen, Pasupathi, Mayr, & Nesselrode, 2000; Carstensen et al., 2011). Older adults report comparable subjective appraisals of various emotions in comparison to younger individuals (Levenson, Carstensen, Friesen & Ekman, 1991; Tasi, Levenson, & Carstensen, 2000). It is likely older adults may be particularly discerning in the emotional states they pursue/engage and when they choose to do so (Carstensen et al. 2000; Mroczek & Klarz, 1998). Furthermore, older adults' effective emotion regulation competency could also be reflected in the fact that rates of certain affective disorders (i.e., major depressive disorder) are three times higher among younger relative older adult samples (American Psychiatric Association, 2013). Furthermore, anxiety disorder prevalence seems to decrease as age increases (Jorm, 2000; Henderson, Jorm, Korten, Jacomb, Christensen, &

Rodger, 1998), with positive emotional experiences either being maintained or slightly increased into advanced old age (Carstensen et al. 2011).

Several theories have attempted to explain positive affect trajectories and emotion regulation competency in late life. One such theory that has garnered much research attention is socioemotional selectivity theory (SST). This theory posits that as people move into later adulthood, time left in life becomes more constrained (Carstensen, Isaacowitz, Charles, 1999; Scheibe & Carstensen, 2010). Due to this limited time perspective, emotional goals begin to take precedence over other life-oriented goals. It becomes more important for older adults to make their daily life more positive (Carstensen et al., 1999; Scheibe & Carstensen, 2010). Some studies have also observed this effect in young adults when a limited time perspective manipulation is provided (Barber, Optiz, Matsins, Sakaki, & Mathers, 2016).

Older adults' motives for present-oriented positivity have been inferred through studies examining information processing biases observed during the presentation of emotionally laden material. Specifically, older adults tend to show a greater preference in their attention and memory for positive, and/or a decreased preference for negative, information, commonly referred to as a "positivity effect" (Mathers & Carstensen, 2005; Carstensen & Mikels, 2005; Charles, Mathers & Carstensen, 2003; Mikels, Reed, & Simon, 2009; Carstensen, 2006). Several previous studies have documented age-related positivity effects. Research examining attentional preferences using eye tracking techniques have observed diminished fixation times to negative, and increased fixation times to positive, stimuli (i.e., facial expressions, pictorial images, video clips) in comparison to younger adults (Isaacowitz, Allard, Murphy, & Schlangel, 2009; Charles

et al., 2003; Mathers & Carstensen, 2005; Isaacowitz, Wadlinger, Goren & Wilson, 2006). Age-related positivity has also been demonstrated in a variety of memory paradigms, including autobiographical memory, working memory, short-term memory, and even within certain false memory tasks (Mikels, Larkin, Reuter-Lorenz, & Carstensen, 2005; Charles et al., 2003; Kennedy, Mathers, & Carstensen, 2004; Fernandes, Ross, Wiegand, & Schryer, 2008). While myriad evidence is available for positive information processing biases, assumed to be in the service of older adults' emotional goal preferences, age-related positivity is not ubiquitous (Schryer & Ross, 2013; Kensinger et al. 2002; Grühn et al. 2005). Additionally, there may also be limits to older adults' efficacy with managing negative affective states for purposes of desired hedonic regulatory outcomes. In cases where certain emotion regulation strategies are not properly employed, or when the emotion to be regulated is highly intense/distressing, effective regulation becomes more difficult for older adults (Charles, 2010; Charles & Luong, 2013). Older adults may need to be particularly discerning when deploying appropriate strategies necessary for effective outcomes. The Strengths and Vulnerability Integration theory (SAVI; Charles, 2010) provides a plausible account for this discernment. SAVI is an extension of SST, whereby successful emotion regulation in old age is contingent on one's ability to maximize behaviors/strategies that draw on available strengths and resources (i.e., social competence, experience, knowledge) while mitigating exploitation of one's vulnerabilities (i.e., cognitive constraints, physiological limitations, etc.). In accordance with SAVI, older adults likely benefit most when they avoid particularly taxing elicitors. This can be reflected in older adults' "strengths" of drawing on experience in knowing when to remove oneself from a situation, modify the current

situation, or selectively engage with non-threatening aspects of a situation. This strength/vulnerability awareness can lead to a decrease in the experience of high intense negative states (i.e., anger resulting from conflicts and confrontation, intense anxiety/fear, etc.) through selective avoidance (Scheibe & Carstensen, 2010).

Emotional Functioning from a Discrete Emotions Perspective

The compromising nature of high intense negativity has been observed in several studies. Recent work has shown that older adults who excessively express anger are more likely to have negative health issues (Boylan & Ryff, 2015), which could be due to difficulties with calming down from a frustrating event/interaction (Keil & Freund, 2009). For instance, Wzrus, Muller, Wagner, Lindenberger, and Riediger (2014) had participants perform a social cognitive stress and mental arithmetic task designed to elicit frustration. While older adults were less physiologically reactive (as indexed through heart rate) in comparison to a sample of younger adults, older adults were slower to recover from the stressors. Thus, older adults' abilities to effectively manage certain affective states may be contingent on the specific emotion present (and its relative intensity) and the corresponding strategy that matches the resources older adults have the capacity to deploy. Conversely, age-related differences in affective experience from a Discrete Emotions Approach (DEA) argues that specific emotions may be imbued with different levels of motivational relevance at different ages (Kunzmann, Rohr, Wieck, Kappes, & Wrosch, 2017). One key distinction in recent literature has been the developmental trajectories in experienced anger versus sadness. Younger and older adults have been shown to differ in terms of their reactivity and regulatory profiles for these two emotions (Kunzman, Richter & Schmukle, 2013). Anger tends to be better managed at

younger ages, while sadness may be more effectively (or at least comparably) regulated at older ages. Anger is often elicited in situations where a blocked goal is experienced and when persistence is adaptive to facilitate assertive resolutions (Levine, 1996; Fischer & Roseman, 2007; Lench & Levine, 2008; Kunzmann et al. 2017). Younger adults experience anger more frequently, experience it more intensely, and regulate it more effectively than older adults (Charles & Carstensen, 2008). This could be due to the fact that urges to actively pursue and achieve long-term goals are more prevalent in younger relative to older adulthood. Anger may be more adaptive and relevant at younger ages (Kunzmann, Richter & Schmukle, 2013). This is highlighted by a few recent studies. One study had participants verbalize their emotions and thoughts out loud while listening to a tape recording of conversation segments, as well as rate their experience of specific affective states. These conversations included issues within a social setting. Older adults tended to report less anger than younger adults, with younger adults reporting higher levels of emotionality in general (Charles & Carstensen, 2008). Also, Kunzmann et al. (2017) observed that across a variety of emotional-eliciting contexts, older adults experienced less anger than their younger counterparts. Sadness reactivity and regulation provides a contrast in terms of age-related trajectories in experience and regulation. While anger may be experienced less frequently in old age, this may not be the case for sadness. Recent evidence suggests that sadness may be more evoking and relevant at older relative to younger ages (Kunzmann, et al., 2017), while additional work suggests that older adults may be more adept than younger adults at regulating sadness. A previous study had younger and older adults view film clips depicting scenes of sadness and loss in different explicit emotion regulation conditions. Older adults reported the films to be

more upsetting in comparison to the younger adults. While older adults experienced the films as more evocative, they were able to successfully regulate responses to those films, even more effectively with certain strategies in comparison to younger adults (Lohani & Isaacowitz, 2014). Additional research suggests that sadness may not be as arousing or physiologically difficult to handle in comparison to emotions assumed to be higher on the arousal scale (i.e., anger: Boylan & Ryff, 2015). Thus, research is somewhat equivocal as to whether sadness is more effectively managed in old age either due to sadness being less arousing or more relevant in old age.

Comparing Predictions from SAVI and DEA

Given mixed evidence regarding emotional reactivity and recovery profiles for a variety of specific affective states across adulthood, further probing the affective arousal/relevance dichotomy is necessary (Kunzmann et al. 2017). This exploration could help expand the theoretical frameworks currently used to better understand emotion regulation competency across the adult lifespan. Previous research has attempted to interrogate the contributions of a discrete emotions viewpoint when determining reactivity and regulation profiles for anger and sadness. From a SAVI perspective, older adults are compromised (due to cognitive and physiological limitations) when attempting to deal with anger elicitors, as such elicitors are assumed to be rather intense and arousing. Conversely, older adults may be more adept at regulating sadness due to its less arousing features. From a DEA perspective, older adults' lack of efficacy when dealing with anger, and greater efficacy with sadness, follows from developmental relevance: anger is a more useful and informative emotion in young adulthood; sadness is more relevant and useful in old age. Both theories could account for age-related trajectories in

sadness and anger reactivity/regulation across adulthood. In order to determine whether arousal and/or relevance frameworks provide more explanatory power for these age-related shifts, it is important to assess additional discrete states that could share the arousal features of anger, as well as the relevance features of sadness, among older adults. For the present study, we included a complementary examination of fear and disgust elicitors. As can be seen in Figure 1, fear and disgust share the same affective space as anger, in terms of high negativity and high arousal, as outlined by Russell and Barrett's (1999) circumplex model of emotion. Fear and disgust have inherent adaptive value across the age spectrum. Fear is useful for cuing environmental threat, while disgust signals potential contamination dangers (Gray, 1987; Tybur, Lieberman, Kurzban, & DeScioli, 2013). Thus, both fear and disgust could provide a useful test case for comparing SAVI and DEA predictions. In other words, if older adults are limited in their ability to effectively manage the experience of high intensity/arousing states, then they should be less effective at regulating their in-the-moment experience of fear and disgust (as has previously been the case with anger). If fear and disgust maintain their adaptive relevance/usefulness in old age, older adults should be particularly adept at managing their reactions to fear and disgust elicitors (similar to what has previously been observed with sadness). These differences can be seen in Table 1.

Present Study

The present study assessed emotional reactivity and regulation profiles across a wider range of discrete emotions to more fully investigate age-related trajectories in emotion control/modulation. Ultimately, we examined whether age-related differences emerge as predicted from a relevancy/usefulness viewpoint (via the DEA model) or an

arousal viewpoint (as suggested by the SAVI model). The relevancy viewpoint argues that individuals should be more adept with emotions that fit within an adaptive framework for an individual to effectively manage age-specific developmental opportunities and constraints (Kunzmann & Wrosch, in press). In other words, younger and older adults should be differentially motivated to engage with certain emotions more than others. The arousal viewpoint argues that individuals at different ages should be more or less adept at (or motivated with) engaging specific emotional states/elicitors based on how well those states can be managed with available resources. Specifically, for older adults, emotional states that are most taxing to one's (namely physiological and/or cognitive) capacities would be most difficult to manage. However, older adults should be as (if not more) capable with managing emotional states that are less physiologically/cognitively constraining.

A comparison of these two competing predictions should better elucidate trajectories of negative affective experience and regulation across adulthood and old age. Both the SAVI (Charles, 2010) and DEA models (Kunzmann et al., 2017) provide conceptual frameworks for addressing developmental age-related shifts in affective experience. No prior study has, within the same experimental paradigm, pitted these two competing theories against each other. Thus, the present study has the potential to provide significant contributions to theoretical conceptualizations of emotional aging. This is accomplished through a more critical analysis of whether age-related emotional experience follows along the line of a dimensional (SAVI) continuum or categorical (DEA) structure. Given that prior research on the DEA framework has focused on just two emotional states (i.e., anger and sadness) assumed to have variable developmental

relevance (and vary in arousal) for both younger and older adults, the present study will include a wider range (i.e., fear and disgust, along with anger and sadness) of affective states to address competing SAVI and DEA predictions. This inclusion allows for a broader assessment as to the breadth of the dimensional approach (i.e., do fear and disgust align with anger in terms of the arousal continuum based on SAVI?) and/or the specificity of the discrete approach (i.e., do fear and disgust maintain their usefulness/relevance, even in old age?).

Finally, practical implications could be evident based on results from the present study. Evidence more in line with the SAVI framework could provide information regarding the negative affective states older adults will persistently avoid due to the physiological constraints present when encountering those elicitors. In an everyday life context, if fear and disgust are as difficult to manage as anger, older adults may be less amenable to engaging with information that facilitates such reactions. In the context of health behavior change, presenting older adults with fear appeals (i.e., distressing images/statistics of disease risks) may be less effective in promoting adaptation (i.e., beginning a healthy behavior or ceasing an unhealthy behavior). Conversely, if fear and disgust maintain their adaptive relevance (similar to sadness, as predicted by DEA), information presented in a fear/disgust context may actually be beneficial. In this case, fear and disgust-eliciting information could be useful for facilitating behavior change within an important health domain. Thus, by addressing SAVI and DEA predictions for better understanding affect trajectories in adulthood and old age, there is an opportunity for us to advance theoretical and practical knowledge within the broader field of emotional aging.

Older and younger adults viewed a series of negative affect-eliciting video clips from popular films and television shows. Specifically, participants viewed separate clips designed to elicit sadness, anger, disgust, and fear. Our measure of affect modulation was derived from an assessment of mood recovery, evidenced by changes to self-report and physiological indicators of emotional experience subsequent to each viewing task. The purpose for assessing mood repair is due to the inconsistent evidence regarding the meaning of emotion reactivity as a proxy variable indicating emotion regulation processes across adulthood and old age (Uchino, Birmingham, & Berg, 2010). If older adults are less physiologically reactive than younger adults during the presentation of an evocative stimulus, this does not necessarily indicate that older adults are engaging in effective regulation processes. As evidenced by an aforementioned study examining younger and older adults' responses to a frustration elicitor, older adults reacted less robustly than younger adults, but (more importantly) they also recovered more slowly (Wrzus et al., 2014). Interrogating how well younger and older adults repair their moods from these specific negative affect elicitors will provide a clearer picture of age-related competency in negative affect regulation.

To assess mood repair in response to specific negative affect elicitors, we examined changes to self-reported negative affect, as well as changes to psychophysiological responding indexed through respiratory sinus arrhythmia (RSA). Several previous studies have examined RSA as a useful index of emotional responding and regulation (Beauchaine, 2001; Diamond & Hicks, 2005; Williams, Cash, Rankin, Bernardi, Koenig & Thayer, 2015). RSA reflects the variation between heartbeats at the frequency of an individual's respiratory range. More specifically, the heart beats in an

asynchronous way. This asynchrony is associated with changes to respiration (Berntson et al. 1997; Bernardi, Porta, Gabutti, Spicuzza & Sleight, 2001): when we inhale, heart rate speeds up; when we exhale, heart rate slows down. With an electrocardiogram (ECG) and a respirometer (used to assess respiration that tracks with variation in heart beats), we can non-invasively measure RSA in real time. Furthermore, there is evidence to suggest that RSA is a valid index of parasympathetic nervous system activity (or “vagal tone”). RSA amplitude is one measure for quantifying vagal tone (Butler, Wilhelm, & Gross, 2006; Porges, 1995). A decrease in RSA from an initial baseline when experiencing an emotionally relevant elicitor is indicative of vagal withdrawal. Influence from the parasympathetic nervous system is being withdrawn when a stressor or emotional elicitor is of current interest to the individual. This is often referred to as “RSA reactivity,” which is computed as mean RSA while experiencing the elicitor minus mean RSA during a baseline (i.e., when the individual is at rest and not engaged in any task; Alkon et al., 2003). RSA recovery can also be assessed (which is a reliable proxy of post-task regulation; Santucci et al., 2008), which is measured through an assessment of RSA during a post-task period (i.e., either during a second baseline task or a guided recovery task).

Porges’ polyvagal theory (Porges, 1995; Porges et al., 1996) argues that the vagal system plays a significant role in self and emotion regulatory processes/behaviors. At rest, parasympathetic activity typically results in high RSA levels, indicated by a slowed heart rate. Higher RSA reflects a greater capacity to engage in self-regulation and sociable behaviors. When faced with a physiological challenge, the “vagal brake” is withdrawn, allowing heart rate to increase and prompting the individual to meet the

demands of the elicitor. Once that stressor has eased/diminished, individuals should demonstrate vagal recovery, returning (at least near) to their original baseline. Thus, an adaptive RSA response pattern would be indicated by significant RSA withdrawal during a stressor followed by subsequent RSA recovery.

Prior research suggests that individual differences in RSA are associated with both adaptive and maladaptive regulatory behaviors. Higher levels of baseline RSA, as well as greater decreases (withdrawal) in RSA are associated with increased positive (and decreased negative) affect and utilization of more adaptive emotion regulation strategies and behaviors (Blandon et al., 2008; Hessler & Katz, 2007). Conversely, individuals who experience diminished RSA recovery after a stressor task engage in more maladaptive emotion regulation strategy deployment (Santucci et al., 2008). Thus, RSA patterns could provide valuable insight into age-related differences in emotion regulation efficacy within the discrete contexts employed in the present study.

Based on previous research, two sets of competing hypotheses were tested according to the SAVI (arousal) and DEA (relevance) frameworks. Evidence in line with the SAVI model would be indicated by age-related differences in mood recovery that are contingent on the level of presumed arousal elicited by each negative video. Here, older adults would have more difficulty recovering from the high relative to low arousal videos. Age differences would be most pronounced within the anger, fear, and disgust video conditions whereby older adults' self-reported negative affect would be higher, and RSA recovery would be diminished, in comparison to younger adults. However, recovery from the sadness elicitor (in terms of both self-report and RSA patterns) could be comparable, or even greater, among older relative to younger adults. On the other hand,

evidence in support of the DEA model would suggest that older adults would show at least comparable recovery in response to emotional elicitors that maintain their developmental relevance into old age (i.e., sadness, fear, and disgust) in comparison to those that may not (i.e., anger). With the DEA model, older adults should show at least comparable recovery to younger adults in response to sadness, fear, and disgust videos. However, younger adults would likely still show superior recovery in response to the anger-eliciting video.

Prior to the main study, a pilot study was conducted in order to determine appropriate sadness, anger, fear, and disgust stimuli. Importantly, we needed to locate video clips that would be comparably rated as eliciting the intended emotions. A first round of video selection was conducted by drawing from previous studies (i.e., Gross & Levenson, 1995; Uhrig et al., 2016). Several other videos were selected through the use of the FilmStim database, which included arousal and valence scores from previously tested participants (Schaefer, Niles, Sanchez & Philippot, 2010). At the start of the pilot, 28 different videos were selected, which ranged in duration from 150-240 sec. We recruited a sample of 11 younger adults (aged 18 to 30) and 15 older adults (aged 62 to 79) to view each clip and rate on specific emotion dimensions. Each video was rated on nine different emotion adjectives, including, sadness, happiness, anger, scared, disgust (moral), disgust (contamination), irritable, nervous, and upset. The scales ranged from 1 to 10, with 1 being “not at all” and 10 being “very much.” We considered all videos rated high on “sadness” and “upset” to fit our “sadness” category. Videos with high ratings on “disgust (moral),” “irritable,” and “anger” were considered as fitting our “anger” category. Videos high on “disgust (contamination)” were selected for the “disgust”

category. Finally, videos high on “nervous” and “scared” were placed within the “fear” category. Careful consideration was taken to make sure videos were primarily high on specified emotion labels in comparison to other labels (for instance, ensuring that an “anger” video was not also high on “sadness”). The following films were chosen for each category. The video used for anger is a clip from the movie *Cry Freedom* (3:08 in length). The video depicts a town being destroyed during a clash between protestors and military personnel. The video chosen for sadness is from the movie *21 Grams* (3:21 in length). This video depicts a woman who was just informed that her husband and two daughters have been in a car accident, and there are likely no survivors. The disgust video is from the TV show *Fear Factor* (3:23 in length). In this clip, two participants are engaged in an eating competition that comprises consuming rat hair tortilla chips, Madagascar cockroaches, and blood salsa with maggots. The video selected for fear is an opening scene to a movie *Lights Out* (3:12 in length). This video depicts a monster who can only dwell in the dark and can mysteriously turn off lights to capture her prey. Video ratings from the pilot study can be found in Table 2.

CHAPTER II

METHODS

Participants

A power analysis (conducted using G*Power 3.1 software) determined that for a moderate effect size ($f = .20$), a Type I error rate of .05, and statistical power = .80, a total of 80 participants were needed for a repeated measures ANOVA that consists of a within and between-groups interaction (in this case, Age group \times Emotion type; 40 younger adults, aged 18-35; 40 older adults, aged 60+) needed to be recruited. The recruited sample included 71 participants total, with 40 younger adults (29 women; aged 18-41, $M = 20.21$, $SD = 3.35$) and 31 older adults (20 women; aged 58-82, $M = 69.11$, $SD = 6.67$). However, due to computer issues, data from three younger and five older adults could not be analyzed for the main video tasks. This left us with 37 younger (26 women, aged 18-41, $M = 20.16$, $SD = 3.31$) and 26 older adults (14 women, aged 58-82, $M = 68.25$, $SD = 6.48$) who had full data available for the subjective, experiential ratings during each video condition. For the RSA analyses, an additional one younger and seven older adults were not available due to poor ECG recordings (aberrant signals, signal dropout, excessive movement artifacts,

etc.). Thus, the RSA analyses included 19 older (11 women, aged 58-82, $M = 68.57$, $SD = 6.86$) and 35 younger adults (26 women, aged 18-41, $M = 20.71$, $SD = 4.70$). Younger adults were recruited through the Cleveland State University SONA participant database, and older adults were recruited through established participant databases in our laboratory, the Project 60 student database at CSU, and an online recruitment service (ResearchMatch). Participants were excluded if they did not have normal-to-corrected-normal vision, history of any neurological issue or disorder (including a concussion within the past 2 years), any history of cardiovascular disease, or any history of a mental illness. Participants were also excluded if on any current medications that could impact their responses to the emotion-eliciting videos (i.e., antidepressants, benzodiazepines, etc.) or the psychophysiological recording (i.e., blood pressure medication, blood thinners, etc.). Participants were also asked to refrain from wearing eye make-up or consuming any caffeine or tobacco products within 5 hours of participating. Participants received either research credit or \$10/hr for their participation.

Measures

Video stimuli. The video stimuli were selected from the aforementioned pilot study. Mean ratings for selected videos across each emotion category are listed in Table 2. Videos with similar specific emotion ratings between age groups were selected.

Stimulus presentation and psychophysiological recording. Videos were presented on a 22" flat-screen monitor, at a distance of 50-70cm from each seated participant. Senomotoric Instruments Experiment Center software was used for the video presentation. This presentation software was utilized since eye-tracking recording was conducted during the protocol. However, the eye tracking metrics are beyond the

scope of this thesis and will not be discussed further. Heart and breathing rate were recorded via an electrocardiogram (ECG) using a BIOPAC MP150 system. ECG recording was conducted by placing Ag/AgCL electrodes to the torso in a modified Lead-II configuration. ECG biosignals was acquired at a 2,000Hz frequency and submitted through a 0.01 high-pass filter. Interbeat intervals of the ECG waveform were interpolated into 250-ms segments and subjected to a fast fourier transformation (Berntson et al., 1997). Kubios HRV 2.2 software was used to calculate RSA values. High-power values (ms^2) within the typical adult human respiration range (.15-.40Hz) were log-transformed to calculate our RSA indices. This was done in order to better normalize the distributions of RSA values within the high-power frequency band (Riniolo & Porges, 2000). RSA values were generated from a 3-min, free-breathing baseline, along with each video presentation trial and subsequent recovery period.

Affect and cognitive measures. To ensure that our younger and older adult samples were typical of prior research assessing aspects of emotion and aging, several self-report affective and cognitive assessments were conducted. The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegan, 1988) and the 5-item Satisfaction with Life scale (SWLS; Diener et al., 1985) was used to assess general subjective well-being. Given that level of depressive and trait anxiety symptomology can impact in-the-moment emotional experiences, particularly when presented with depression and anxiety-relevant (i.e., sadness and fear) elicitors (i.e., Ehring et al., 2010), participants completed the Center for Epidemiological Studies depression scale (CES-D; Radloff, 1977) and the trait subscale of the State-Trait Anxiety Inventory (STAI; Spielberger, 1989) in order to assess any potential depressive or anxiety symptomology

that could impact our predicted results. Furthermore, since executive control/prefrontal functioning is highly involved in emotional processing and regulation (Ochsner & Gross, 2005; Zelazo & Cunningham, 2007), a composite battery of executive functioning tasks derived from Glisky, Polster, & Routhieaux (1995) was included. These tasks comprised a word fluency test to assess verbal ability (Benton & Hamsher, 1976), a backwards digit span task (Wechsler, 1987), a mental control task (Wechsler, 1987), and a mental arithmetic task (Wechsler, 1981). Any observed age differences across these aforementioned measures were included as covariates in our main omnibus analyses.

Procedure

Upon entering the lab, participants were given a consent form to read and sign. After consenting, participants completed the four self-report affect measures (PANAS, SWLS, CES-D, and STAI). Participants were next fitted with the ECG and respiration equipment. Three electrodes were placed on the participant's torso (one each below the left and right clavicle and one just below the bottom left rib). Electrode leads were connected to an ECG and respiration transmitter, which was connected to a belt that is placed around the participant, just below the diaphragm. Participants were seated between 50 and 70cm from a computer monitor while still having access to a keyboard and mouse.

Prior to the video tasks, participants were then led through a baseline assessment of their heart and breathing rate. Participants were instructed to look directly at a fixation cross on the center of the monitor and to relax and breathe normally for 3min. Participants were then presented with the first negative video clip. The order of video presentation was counterbalanced across participants. Participants were instructed that

while viewing the video, they should allow themselves to experience any emotional reactions that emerge and to not avoid or try to regulate their reactions. After each film, participants provided the next set of affect ratings, which was followed by a recovery period. The recovery task consisted of an attentional refocusing manipulation whereby participants viewed a colorful, moving kaleidoscope video. Participants were instructed to pay attention to the moving shapes and changing colors for a total of 2.5min. Following the recovery task, participants provided another set of affect ratings. This same procedure was completed 3 more times for the remaining videos. After recovery from the 4th video, participants watched a pleasant video clip (from the movie *WALL-E*) in order to help relieve any residual negative affect from the prior videos. Finally, participants completed the cognitive battery, were debriefed, and thanked for their time. The entire protocol took roughly 90 – 120min.

CHAPTER III

RESULTS

A series of independent-samples *t*-tests were conducted on the demographic, affective, and cognitive measures (Table 3). Younger adults had significantly higher depression and trait anxiety scores in comparison to the older adults ($ps < .001$). Older adults reported more positive affect ($p < .001$) and less negative affect, ($p = .007$) in comparison to younger adults. Older adults also had significantly more years of education ($p < .001$) compared to the younger adult sample. There were slight differences in cognitive ability between younger and older adults, with older adults outperforming younger adults on mental math ($p = .014$) and the backwards digit span ($p = .004$). Older adults also had a higher composite executive functioning score ($p = .038$). All measures where age differences emerged were included as separate covariates in our main omnibus analyses.

Physiological Results

For the RSA data, 2 (Age group: older adult, younger adult) \times 3 (Epoch: baseline, video viewing, recovery) factorial ANOVAs, with Age as the between-subjects factor and Epoch as the within-subjects factor, were conducted. Results for the sad video task

revealed a main effect of Age, $F(2, 51) = 4.06, p < .05, \eta_p^2 = .07$, which indicated that RSA values were higher for younger ($6.65 \pm .28$) relative to older adults ($5.72 \pm .37$). The main effect of Epoch, $F(2, 102) = .06, p = .96, \eta_p^2 = .001$, and the Age \times Epoch interaction, $F(2, 102) = .27, p = .77, \eta_p^2 = .005$, were not significant (see Figure 2). Results for the anger video also revealed a significant main effect of Age, $F(1, 51) = 6.26, p = .02, \eta_p^2 = .11$, with younger adults demonstrating higher RSA values ($6.76 \pm .27$) than older adults ($5.65 \pm .36$). However, the main effect of Epoch, $F(2, 102) = .20, p = .82, \eta_p^2 = .004$, and the Age \times Epoch interaction, $F(2, 102) = .31, p = .74, \eta_p^2 = .006$, were not significant (see Figure 3). For the fear video, there was a non-significant main effect of Age, $F(1, 51) = 2.81, p = .10, \eta_p^2 = .05$. There was also a non-significant main effect of Epoch, $F(2, 102) = 2.56, p = .08, \eta_p^2 = .05$, and a non-significant interaction, $F(2, 102) = .79, p = .46, \eta_p^2 = .02$ (see Figure 6). Finally, for the disgust video, there was a significant main effect of Age, $F(1, 51) = 5.17, p = .03, \eta_p^2 = .09$, with younger adults' values ($6.79 \pm .27$) higher than older adults' ($5.75 \pm .75$). Here, there was also a non-significant main effect of Epoch, $F(2, 102) = 1.04, p = .36, \eta_p^2 = .02$, and a non-significant interaction, $F(2, 102) = .55, p = .58, \eta_p^2 = .01$ (see Figure 5).

The questionnaire and cognitive measures that revealed age differences (composite executive functioning score, Education, CES-D, STAI, PA, and NA) were originally entered as covariates in the omnibus RSA analyses. However, the aforementioned findings were unchanged with the addition of these covariate measures.

Self-Reported Affect

Prior to examining age differences in subjective reactivity and recovery ratings across the four video tasks, we examined whether the intended emotion for each video

was being elicited for both the younger and older adult samples. A series of repeated-measures ANOVAs were conducted to assess differences in the target affect label (sad, anger, scared, contamination disgust) for each video out of the nine affect labels provided (see Table 4). For instance, the sadness ratings during the sadness video task were compared against the other eight affect categories, while anger ratings were compared against the remaining categories for the anger video, contamination disgust for the disgust video, and scared ratings for the fear video. For the sadness video, sad affect ratings were higher for younger adults (all $ps < .05$) in comparison to the other eight adjectives, while the same was the case for older adults for all other adjectives except for upset (all $ps < .001$). For the anger video, younger adults' anger ratings were actually lower than their moral disgust ratings ($p < .001$) but higher than their nervousness and happiness ratings ($ps < .05$). No other comparisons reached statistical significance. For older adults, anger ratings were higher than their happy, scared, and nervousness ratings (all $ps < .001$). However, anger ratings were comparable to the remaining affect categories. For the disgust video, contamination disgust ratings were higher for younger adults in comparison to all of the other affect categories, with the exception of moral disgust (all $ps < .001$), while older adults contamination disgust ratings were higher for all ($ps < .05$) but their moral disgust, irritable, and upset ratings. Finally, for the fear video, scared ratings were higher for younger adults relative to all other affect labels (all $ps < .05$) other than nervous. For older adults, scared ratings were higher for all other affect labels (all $ps < .01$) with the exception of their irritable, nervous, and upset ratings.

We next examined potential age differences in reactivity and recovery profiles for the target affect rating for each of the four videos. Here, separate 2 (Age group: older

adult, younger adult) \times 2 (epoch: reactivity, recovery) factorial ANOVAs were conducted. For the sadness video, there was a significant main effect of Age, $F(1,62) = 7.87, p = .007, \eta_p^2 = .11$. Older adults ($4.92 \pm .34$) reported higher sadness ratings than did younger adults ($3.70 \pm .28$). The main effect of Epoch was also significant, $F(1, 62) = 208.35, p < .001, \eta_p^2 = .77$, with sadness ratings being higher after viewing the video ($6.90 \pm .34$) as compared to after the recovery period ($1.72 \pm .21$). The Age \times Epoch interaction was also significant, $F(1, 62) = 6.20, p = .02, \eta_p^2 = .09$. Simple main effects analyses were conducted on the significant interaction, revealing that older adults' sadness ratings ($7.96 \pm .53$) were higher than younger adults' ($5.84 \pm .44$) after the video, $F(1,62) = 9.60, p = .003, \eta_p^2 = .13$; however, both younger and older adults had comparable sadness ratings after the recovery period ($p = .43$; see Figure 6).

For the anger video, there was a significant main effect of Age, $F(1, 62) = 17.20, p < .001, \eta_p^2 = .22$, with older adults reporting higher anger ratings ($4.71 \pm .34$) as compared to younger adults ($2.90 \pm .28$). There was also a significant main effect of Epoch, $F(1, 62) = 84.63, p < .001, \eta_p^2 = .58$, with participants reporting higher anger ratings after the video ($5.78 \pm .35$) as compared to after the recovery period ($1.83 \pm .26$). These two main effects were qualified by a significant interaction, $F(1, 62) = 14.948, p < .001, \eta_p^2 = .19$. Simple main effects analyses revealed that older adults ($7.50 \pm .54$) had higher anger ratings than younger adults ($4.05 \pm .45$) after the anger video, $F(1, 62) = 24.29, p < .001, \eta_p^2 = .28$; however, the two groups' ratings did not differ after the recovery period ($p = .72$; see Figure 7).

For the disgust video, there was no significant main effect of Age on contamination disgust ratings, $F(1,62) = .17, p = .68, \eta_p^2 = .003$. However, there was a

significant main effect of Epoch, $F(1,62) = 148.34, p < .001, \eta_p^2 = .71$, with participants reporting higher contamination disgust ratings after the video ($7.03 \pm .43$) as compared to after the recovery period ($1.70 \pm .19$). There was no significant Age \times Epoch interaction, $F(1, 62) = 1.01, p = .32, \eta_p^2 = .02$ (see Figure 8).

Finally, for the fear video, there was no significant main effect of Age, $F(1, 62) = 2.84, p = .10, \eta_p^2 = .04$. However, there was a significant main effect of Epoch, $F(1, 62) = 127.83, p < .001, \eta_p^2 = .67$, with participants reporting higher scared ratings after the video ($5.60 \pm .38$) than after the recovery period ($1.36 \pm .13$). Furthermore, the interaction was not significant, $F(1, 62) = 2.36, p = .13, \eta_p^2 = .04$ (see Figure 9).

As with the self-reported affect analyses, the executive functioning composite, education, CES-D, STAI, PA, and NA variables were assessed as separate covariates in our main omnibus analyses. The original results remained unchanged with the addition of these covariates.

Discussion

The present study explored whether relevancy or the arousal of affective states may be more predictive of age-related differences in emotional reactivity and recovery processes. With previous research on sadness and anger, disgust and fear were additionally included to get a clearer picture of negative affect regulation profiles across adulthood and old age. For SAVI (Charles, 2010), it is thought that stimulus arousal may be key to the types of emotions individuals are willing to experience at different ages. For instance, high arousal emotions (such as anger) may be difficult for older adults to manage due to limits in physiological and cognitive capacities. Thus, older adults may be

best served by avoiding anger-elicitors. From a SAVI perspective, it was possible that older adults would be less amenable to experiencing and regulating emotions that fall on the higher end of the arousal scale, such as disgust and fear. Here, the SAVI model would predict that older adults would be less reactive, and recover less robustly, to fear and disgust elicitors. The DEA model (Kunzmann et al., 2017) argues that negative emotional experience may be more dictated by relevance of the elicitor (i.e., which emotions are important and common during a specific time in life?). Thus, older adults may be more likely to effectively manage emotional states that have greater self-relevance (i.e., sadness, which is linked to the experience of loss and tends to be more prominent at older ages). Now, from a DEA perspective, it is possible that the adaptive relevance of additional negative states (including fear and disgust, which are both linked to survival) would be effectively experienced and managed in old age. These two aforementioned frameworks were tested in a sample of younger and older adults who were tasked with experiencing and recovering from specific sadness, anger, fear, and disgust elicitors in a laboratory setting.

Heightened Reactivity and Adept Recovery in Old Age

Several interesting findings emerged when examining participants' subjective emotional experience to the video tasks. Overall, participants reported relatively high levels of the target emotion for each video, while also demonstrating robust recovery after the attentional refocusing tasks. Furthermore, older adults tended to report higher reactivity ratings, particularly for the sadness and anger videos, in comparison to younger adults, while demonstrating comparable recovery to their younger counterparts. Results for the sadness video were in line with our predictions and in keeping with past research

examining older adults' sadness regulation (Kunzmann, et al., 2017; Boylan & Ryff, 2013). However, results from the anger video task are contrary to our hypotheses from both the SAVI and DEA perspectives. Much prior research has observed that older adults' generally tend to avoid anger provocations (Blanchard-Fields & Heckman-Coats, 2008; Tsai, Levenson, & Carstensen, 2000) and report less subjective reactivity in response to laboratory-based (Kunzmann & Grühn, 2005; Kunzmann & Richter, 2009) and self-generated (i.e., autobiographical memories) anger elicitors (Kunzmann et al., 2017).

However, there are a number of possibilities as to why our older adults showed heightened reactivity (and adept recovery) to the anger elicitor used in the present study. One key factor could be the nature of the events being portrayed in the anger video. For the anger elicitor, participants watched a scene depicting soldiers brutally arresting and killing innocent civilians. This video has previously been validated in prior studies, as well as our pilot study, to elicit feelings of anger (Gross & Levenson, 1995; Hewig et al., 2005; Uhrig et al., 2016); however, instead of anger being elicited in response to a blocked goal, anger in this case could be perceived as being the result of a moral violation/social injustice. Prior work suggests that older adults might actually be more reactive to violations of justice and morality as compared to younger adults (Jiang, Li, & Hamamura, 2015). In fact, one prior study using the same anger video as the present study observed that older adults were more reactive (in terms of self-reported ratings and facial expressions) to the video than were younger adults (Phillips, Henry, Hosie, & Milne, 2008). This is in contrast to studies observing that older adults are less reactive (and maybe less adept at managing) anger elicitors where the individual, him or herself,

is the target of the transgression, such as when imagining an event where someone/something angered the participant directly (Kunzmann et al., 2017). Thus, older adults may be more or less willing experience anger based on the type and target of the elicitor. More research is necessary to disentangle this possibility.

The heightened reactivity observed among older adults for the anger video could also be a function of the level of mixed emotional experiences reported by our participants. As can be seen in Table 4, while the anger video was chosen in order to primarily elicit anger, subjective ratings were quite high for other emotional states (i.e., sadness, upset, moral disgust) for older adults (and younger adults actually had higher moral disgust relative to anger ratings). The fact that the anger video also elicited feelings of sadness (an emotion older adults adeptly manage, see Kliegel, Jäger, & Phillips, 2007; Lohani & Isaacowitz, 2014) could have led to older adults effective reactivity and management of their subjective experience. The mixed emotional nature of the anger video, and older adults' reactivity and recovery efficacy, is in keeping with previous literature suggesting that older adults often report experiencing mixed emotional states, typically referred to as "poignancy" (Schneider & Stone, 2015). Furthermore, older adults are quite effective at managing these mixed affective experiences (Ersner-Hershfield, Carvel, & Isaacowitz, 2009). Hence, particularly for older adults, feelings of "anger" in a traditional sense of a blocked personal goal (Fischer & Roseman, 2007; Lench & Levine, 2008) may not have been what older adults experienced during this task, suggesting a more nuanced approach to "anger" relevance in old age.

Another issue with the anger video is related to younger adults' subjective ratings. Younger adults actually rated the video higher on moral disgust than anger. Thus, similar

to older adults, younger adults may have been perceiving the video more in terms of the social injustices being perpetrated. In contrast to older adults, younger adults might experience anger more commonly in situations where they, themselves, are the targets of the transgression (Blanchard-Fields & Heckman-Coats, 2008; Kunzmann et al., 2017). During instances where younger adults report higher anger reactivity in comparison to older adults, the elicitors tend to be related to a personal slight or blocked goal (Kunzmann et al., 2014). Therefore, variable age differences in anger reactivity (and recovery) likely depend on how anger targets/elicitors differ for both older and younger adults.

While there was variability in the subjective experiences reported for each emotional video, overall both older and younger adults reported moderate to high levels of each target emotion and, more importantly, robust subjective recovery from each video. Thus, it could be the case that the arousal-based predictions suggesting that older adults have difficulty with managing high arousal emotions (anger, fear, and disgust) may not fit best with the present results. However, in order to determine whether the DEA framework would best fit the present data, we would need to further assess the varied elicitors that differentially lead to discrete emotional experiences for younger and older adults. The mixed emotional nature of the anger video could perhaps signal more nuance into the contexts whereby sub-categories within a specific emotion are still relevant and useful in old age.

Inconclusive RSA Results

When examining our physiological metrics via RSA, evidence of distinct age profiles regarding reactivity and recovery were not observed. Specifically, changes in

RSA from baseline were not revealed for either age group within any of the video tasks. The only significant results observed were general age differences in RSA patterns, with RSA values being lower for older relative to younger adults, which is a common finding in the literature (Wrzus et al. 2013; Hogan, James, McCabe, Kilmartin, Howard & Noone, 2012). This leads to questions regarding the evocative nature of the stimuli used or the validity of the cardiovascular measures/analyses employed. While the self-report affect ratings suggest that participants were experiencing, in most cases, the intended emotion, our physiological metrics are less convincing. It is possible that the videos employed did not elicit sufficient levels of arousal for a noticeable change in cardiac responses. While the stimuli were piloted prior to the study, they were only selected based on subjective ratings. Future work could include assessments of more distinctly evocative elicitors (i.e., self-relevant autobiographical events) to better delineate physiological mechanisms underlying age-related differences in discrete negative affect regulation.

Another issue with our RSA metrics was the small sample of older adults ($n = 19$) available for full analyses, which likely led to power issues for observing any significant age interactions if they were actually present. Due to issues with recruitment and equipment challenges for obtaining clean ECG signals from our older participants, a larger OA sample was currently not possible. There are plans to continue data collection in order to address this issue.

While these physiological measures could provide an extremely valuable methodology used to parse out potential differences, additional considerations should be noted. There have been past studies that have shown stark differences between subjective

and autonomic emotional responses within older adult samples. Maturational dualism argues that with advanced age, emotional experience shifts from more of a physiological to a cognitive/experiential frame. This is presumed due to greater difficulty in one's ability to maintain "mind-body" connectivity (Berry Mendes, 2010). Thus, while older adults' subjective emotional reports were quite robust, physiological reactivity was somewhat blunted. Evidence in line with this possibility comes from one study demonstrating that older adults' subjective affective reports did not match their physiological responses (via skin conductance measures). However, subjective reports and skin conductance measures were aligned among a sample of younger adults. This could suggest a potential break in the coherence between cognitive-emotional awareness and physiological arousal among older adults (Neiss, Leigland, Carlson, & Janowsky, 2009). One counter against this interpretation was that while younger adults evidenced higher RSA values in comparison to adults, younger adults did not demonstrate robust RSA reactivity and/or recovery changes for any of the video tasks in the present study. Thus, younger adults' subjective ratings also did not track with the autonomic arousal metrics.

Perhaps additional physiological metrics would be useful to better interrogate potential age differences in autonomic arousal across these discrete emotion categories. Alternative measures could be informative for delineating potential age-related differences in physiological reactivity and recovery to the video tasks. While not part of the present thesis project, additional metrics were obtained during the study. Specifically, participants viewed the video tasks while their eyes were tracked; hence, we have the ability to examine visual-based measures of changes in autonomic arousal (namely pupil

dilation; see Allard, Wadlinger, & Isaacowitz, 2010; Li, Fung, & Isaacowitz, 2011; Martins, Florjanczyk, Jackson, Gatz, & Mather, 2018). Such alternative metrics would be advantageous given the recording issues encountered (namely with our older adults) with the ECG assessments. Follow up work is planned for probing these alternative metrics.

Future Directions

A few other limitations and future directions should be noted. For instance, future work should consider assessing the types of contexts where individuals are going to be more reactive (and motivated to regulate) in response to specific elicitors. In addition to our discussion on the types of anger contexts that could be more or less relevant at different ages, certain elicitors could also be more or less age-relevant for motivating reactivity and regulation for other emotional states. For example, previous research has shown that older adults tend to react more to fear stimuli if health consequences are insinuated rather than social consequences (Teachman & Gordon, 2009). Thus, we perhaps need to further breakdown the “discrete” nature of the discrete emotions perspective for interrogating age-related differences in affective processing and regulation.

Another important limitation to the study was in relation to our collection of subjective affect during the video tasks. Specifically, we did not have a measure of baseline affect based on the nine adjective terms used. In order to get a better sense of reactivity profiles, changes from baseline affect would have been more appropriate. However, given that we were most interested in changes from reactivity to recovery (as well as age differences on these two metrics), this omission was not too problematic.

Nevertheless, in order to better account for individual differences in affective experiences prior to coming to the lab, such baseline ratings are warranted.

Conclusions

While more research needs to be completed in this area, aspects of the discrete emotions perspective may be more indicative of age-related variability in emotional reactivity and regulation. Based on the experiential ratings observed in the present study, even for those emotions presumed to be within the domain of “high arousal” (anger, fear, and disgust), older adults reported robust reactivity and recovery. Furthermore, the present findings suggest that additional work into further specifying categories within discrete emotional states could be useful for understanding emotional reactivity and regulatory efficacy across the adult lifespan. Such insights will better contribute to theory and research on the nuanced nature of emotional competencies that are consequential to health and well-being throughout our later years.

References

- Alkon, A., Goldstein, L.H., Smider, N., Essex, M.J., Kupfer, D.J., Boyce, W.T. (2003). Developmental and contextual influences on autonomic reactivity in young children. *Developmental Psychobiology*, *42*, 64-78. doi: 10.1002/dev.10082
- Allard, E.S., Wadlinger, H.A., & Isaacowitz, D.M. (2010). Positive gaze preferences in older adults. Assessing the role of cognitive effort with pupil dilation. *Aging, Neuropsychology, and Cognition*, *17*, 296-311.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Association.
- Barber, S., Opitz, P., Martins, B., Sakaki, M., & Mathers, M. (2016). Thinking about a limited future enhances the positivity of younger and older adults' recall: Support for socioemotional selectivity theory. *Memory and Cognition*, *44*(6), 869-882.
- Beauchaine, T. (2001). Vagal tone, development, and Grays motivational theory: Toward an integrated model of autonomic nervous system functioning in psychopathology. *Development and Psychopathology*, *13*(2), 183-214.
doi:10.1017/s0954579401002012
- Benton, A.L., & Hamsher, K. de. S. (1976). *Multilingual Aphasia Examination manual*. Iowa City: University of Iowa.
- Bernardi, L., Porta, C., Gabutti, A., Spicuzza L., & Sleight P. (2001) Modulatory effects of respiration. *Autonomic Neruosceience*, *90* (1-2), 47-56.

- Berntson, G. G., Thomas Bigger, J., Eckberg, D. L., Grossman, P., Kaufmann, P. G., Malik, M., ... & Der Molden, M. W. (1997). Heart rate variability: origins, methods, and interpretive caveats. *Psychophysiology*, *34*(6), 623-648.
- Berry Mendes, W. (2010). Weakened links between mind and body in older age: The case for *maturational dualism* in the experience of emotion. *Emotion Review*, *2*, 240-244.
- Blanchard-Fields, F., & Heckman Coats, A. (2008). The experience of anger and sadness in everyday problems impacts age differences in emotion regulation. *Developmental Psychology*, *44*, 1547-1556,
- Blandon, A.Y., Calkins, S.D., Keane, S.P., & O'Brien, M. (2008). Individual differences in trajectories of emotion regulation processes: The effects of maternal depressive symptomology and children's physiological regulation. *Developmental Psychology*, *44*, 1110-1123. doi: 10.1037/0012-1649.44.4.1110
- Boylan, J. M., & Ryff, C. D. (2013). Varieties of anger and the inverse link between education and inflammation: Toward an integrative framework. *Psychosomatic Medicine*, *75*, 566–574. doi:10.1097/PSY.0b013e3182a0f38e
- Butler, E. A., Wilhelm, F. H., & Gross, J. J. (2006). Respiratory sinus arrhythmia, emotion, and emotion regulation during social interaction. *Psychophysiology*, *43*(6), 612-622. doi:10.1111/j.1469-8986.2006.00467.x
- Carstensen, L. (2006). The influence of a sense of time on human development. *Science*, *30*(312), 1913-1915. doi:10.1126/science.1127488.

- Carstensen, L. L., Isaacowitz, D. M., & Charles, S. T. (1999). Taking time seriously: A theory of socioemotional selectivity. *American Psychologist*, *54*(3), 165-181.
- Carstensen, L., & Mikels, J. (2005). Aging and the positivity effect. *Current Directions in Psychological Science*, *14* (3), 117-121.
- Carstensen, L. L., Pasupathi, M., Mayr, U., & Nesselroade, J. R. (2000). Emotional experience in everyday life across the adult life span. *Journal of Personality and Social Psychology*, *79*(4), 644-655. doi:10.1037//0022-3514.79.4.644
- Carstensen, L. L., Turan, B., Scheibe, S., Ram, N., Ersner-Hershfield, H., Samanez-Larkin, G. R...Nesselroade, J. R. (2011). Emotional experience improves with age: Evidence based on over 10 years of experience sampling. *Psychology and Aging*, *26*(1), 21-33. doi:10.1037/a0021285
- Charles, S. T. (2010) Strength and Vulnerability Integration (SAVI): A Model of Emotional Well-Being Across Adulthood. *Psychology Bulletin*, *136*(6), 1068-1091.
- Charles, S.T., Mather, M., Carstensen, L.L. (2003). Focusing on the positive: Age differences in memory for positive, negative, and neutral stimuli. *Journal of Experimental Psychology*, *85*, 163–178
- Charles, S. & Carstensen. (2008) Social and emotional aging. *Annual Review of Psychology*, *61*, 383-409.
- Charles, S., & Luong, G. (2013). The theoretical model of strength and vulnerability integration. *Current Directions in Psychological Science*, *22* (6), 443-448.

- Diamond, L. M., & Hicks, A. M. (2005). Attachment style, current relationship security, and negative emotions: The mediating role of physiological regulation. *Journal of Social and Personal Relationships*, 22(4), 499-518.
doi:10.1177/0265407505054520
- Diener, E., Emmons, R., Larsen, R., & Griffin, S. The Satisfaction with Life Scale. *Journal of Personality Assessment*, 49(1), 71-74.
- Ehring, T., Tuschen-Caffier, B., Schnulle, J., Fischer, S., & Gross, J. J. (2010). Emotion regulation and vulnerability to depression: spontaneous versus instructed use of emotion suppression and reappraisal. *Emotion*, 10(4), 563.
- Ersner-Hershfield, H., Carvel, D.S., & Isaacowitz, D.M. (2009). Feeling happy and sad, but only seeing the positive: Poignancy and the positivity effect in attention. *Motivation and Emotion*, 33, 333-342.
- Fernandes, M., Ross, M., Wiegand, M., & Schryer, E. (2008). Are the memories of older adults positively biased? *Psychology and Aging*, 23(2), 297-306.
doi:10.1037/0882-7974.23.2.297
- Fischer, A. H., & Roseman, I. J. (2007). Beat them or ban them: The characteristics and social functions of anger and contempt. *Journal of Personality and Social Psychology*, 93(1), 103-115.
- Gray, J. A. (1987). *The psychology of fear and stress*. Cambridge: Cambridge University Press.

- Glisky, E. L., Polster, M. R., & Routhieaux, B. C. (1995). Double dissociation between item and source memory. *Neuropsychology*, *9*(2), 229-235
- Gross, J. J., Carstensen, L. L., Pasupathi, M., Tsai, J., Götestam Skorpen, C., & Hsu, A. Y. C. (1997). Emotion and aging: Experience, expression, and control. *Psychology and Aging*, *12*(4), 590-599. doi:10.1037/0882-7974.12.4.590
- Gross, J., & Levenson, R. (1995). Emotion elicitation using film. *Cognition and Emotion*, *9*(1), 87-108. Doi:10.1080/02699939508408966.
- Grühn D., Smith, J., & Baltes, P. (2005). No aging bias favoring memory for positive material: Evidence from a heterogeneity-homogeneity list paradigm using emotionally toned words. *Psychology and Aging*, *20*(4), 579-588.
- Henderson, A. S., Jorm, A. F., Korten, A. E., Jacomb, P., Christensen, H., & Rodgers, B. (1998). Symptoms of depression and anxiety during adult life: Evidence for a decline in prevalence with age. *Psychological Medicine*, *28*(6), 1321-1328. doi:10.1017/s0033291798007570
- Hessler, D.M., & Katz, L.F. (2007). Children's emotion regulation: Self-report and physiological response to peer provocation. *Developmental Psychology*, *43*, 27-38. doi: 10.1037/0012-1649.43.1.27
- Hewig, J., Hagemann, D., Seifert, J., Gollwitzer, M., Naumann, E., & Bartussek, D. (2005). A revised film set for the induction of basic emotions. *Cognition and Emotion*, *19*, 1095-1109.

- Hogan, M.J., Jame, J.E., McCabe, T.R., Kilmartin, L., Howard, S., & Noone, C. (2012). Cardiovascular reactivity of younger and older adults to positive-, negative-, and mixed-emotion cognitive challenge. *Biological Psychology, 89*, 553-561.
- Isaacowitz, D. M., Allard, E. S., Murphy, N. A., & Schlangel, M. (2009). The time course of age-related preferences toward positive and negative stimuli. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 64B*(2), 188-192. doi:10.1093/geronb/gbn036
- Isaacowitz, D. M., Wadlinger, H. A., Goren, D., & Wilson, H. R. (2006). Selective preference in visual fixation away from negative images in old age? An eye-tracking study. *Psychology and Aging, 21*(1), 40-48.
- Jiang, D., Li, T., & Hamamura, T. (2015). Societies' tightness moderates age differences in perceived justifiability of morally debatable behaviors. *European Journal of Ageing, 12*, 333-340.
- Jorm, A. F. (2000). Does old age reduce the risk of anxiety and depression? A review of epidemiological studies across the adult life span. *Psychological Medicine, 30*(1), 11-22. doi:10.1017/s0033291799001452
- Keil, A., & Freund, A. M. (2009). Changes in the sensitivity to appetitive and aversive arousal across adulthood. *Psychology and Aging, 24*(3), 668-680.
- Kennedy, Q., Mather, M., Carstensen, L. (2004). The role of motivation in the age-related positivity effect in autobiographical memory. *Psychological Science, 15*(3), 208-214.

- Kensinger, E. A., Brierley, B., Medford, N., Growdon, J. H., & Corkin, S. (2002). Effects of normal aging and Alzheimer's disease on emotional memory. *Emotion, 2*(2), 118-134.
- Kliegel, M., Jäger, T., & Phillips, L.H. (2007). Emotional development across adulthood. Differential emotional reactivity and emotion regulation in a negative mood induction procedure. *The International Journal of Aging and Human Development, 64*, 217-244.
- Kunzman, U., & Grün D. (2005). Age differences in emotional reactivity: The sample case of sadness. *Psychology and Aging, 20*, 47-59.
- Kunzmann, U., Kappes, C., & Wrosch, C. (2014). Emotional aging: A discrete emotions perspective. *Frontiers in Psychology, 5*. doi:10.3389/fpsyg.2014.00380
- Kunzmann, U., & Richter, D. (2009). Emotional reactivity across the adult life span: the cognitive pragmatics make a difference. *Psychology and Aging, 24*, 879-889.
- Kunzmann, U., Richter, D., & Schmukle, S. C. (2013). Stability and change in affective experience across the adult life-span: Analyses with a national sample from Germany. *Emotion, 13*(6), 1086-1095. doi:10.2139/ssrn.2328105
- Kunzmann, U., Rohr, M., Wieck, C., Kappes, C., & Wrosch, C. (2017) Speaking about feelings: Further evidence for multidirectional age differences in anger and sadness. *Psychology and Aging, 32*(1), 93-103.
- Kunzmann, U., & Wrosch, C. (in press). Commentary: The emotion-health link— Perspectives from a lifespan theory of discrete emotions. *Emotion Review*.

- Lawton, M. P., Kleban, M. H., Rajagopal, D., & Dean, J. (1992). Dimensions of affective experience in three age groups. *Psychology and Aging, 7*(2), 171-184.
- Levine, L. (2010) The Anatomy of Disappointment: A Naturalistic Test of Appraisal Models of Sadness, Anger and Hope. *Cognition and Emotion, 10*(4), 337-360.
- Lench, H., & Levine, L. (2009) Goals and responses to failure: Knowing when to hold them and when to fold them. *Motivation and Emotion, 32*(2), 127-140.
- Levenson, R. W., Carstensen, L. L., Friesen, W. V., & Ekman, P. (1991). Emotion, physiology, and expression in old age. *Psychology and Aging, 6*(1), 28-35.
doi:10.1037/0882-7974.6.1.28
- Li, T., Fung, H.H., & Isaacowitz, D.M. (2011). The role of dispositional reappraisal in the age-related positivity effect. *Journals of Gerontology: Series B, 66B*, 56-60.
- Lohani, M., & Isaacowitz, D. M. (2014). Age differences in managing response to sadness elicitors using attentional deployment, positive reappraisal and suppression. *Cognition and Emotion, 28*(4), 678-697.
doi:10.1080/02699931.2013.853648
- Martins, B., Florjanczyk, J., Jackson, N.J., Gatz, M., & Mather, M. (2018). Age differences in emotion regulation effort: Pupil response distinguishes reappraisal and distraction for older but not younger adults. *Psychology and Aging, 33*, 338-349.
- Mather, M & Carstensen, L. (2005) Aging and motivated cognition: The positivity effect in attention and memory. *Trends in Cognitive Sciences, 9* (10), 496-502.

- Mikels, J. A., Larkin, G. R., Reuter-Lorenz, P. A., & Carstensen, L. L. (2005). Divergent trajectories in the aging mind: Changes in working memory for affective versus visual information with age. *Psychology and Aging, 20*(4), 542-553.
doi:10.1037/0882-7974.20.4.542
- Mikels, J., Reed, A., Simon, K. (2009) Older adults place lower value on choice relative to young adults. *The Journal of Gerontology, 64*(4), 443-446.
<https://doi.org/10.1093/geronb/gbp021>.
- Mroczek, D. K., & Kolarz, C. M. (1998). The effect of age on positive and negative affect: A developmental perspective on happiness. *Journal of Personality and Social Psychology, 75*(5), 1333-1349.
- Neiss, M. B., Leigland, L. A., Carlson, N. E., & Janowsky, J. S. (2009). Age differences in perception and awareness of emotion. *Neurobiology of Aging, 30*(8), 1305–1313.
- Ochsner, K & Gross, J. (.2005). The cognitive control of emotion. *Trends in Cognitive Science, 9*(5) 242-29.
- Porges, S.W. (1995). Orienting in a defensive world: Mammalian modifications of our evolutionary heritage: A polyvagal theory. *Psychophysiology, 32*, 301-328.
- Porges, S.W., Doussard-Roosevelt, J.A., Portales, A.L., & Greenspan, S.I. (1996). Infant regulation of the vagal “brake” predicts child behavior problems: A psychobiological model of social behavior. *Developmental Psychobiology, 29*, 697-712. doi: 10.1002/(SICI)1098-2302

- Radloff, L. S. (1977). The CES-D Scale. *Applied Psychological Measurement, 1*(3), 385-401. doi:10.1177/014662167700100306
- Riniolo, T.C., & Porges, S.W. (2000). Evaluating group distributional characteristics : Why psychophysicologists should be interested in qualitative departures from the normal distribution. *Psychophysiology, 37*, 21-28.
- Russell J. A. & Barrett, L. F. (1999) Core affect prototypical emotional episodes, and other things called emotion : dissecting the elephant. *Journal of Personality and Social Psychology, 76*(5), 805-819.
- Santucci, A.K., Silk, J.S., Shaw, D.S., Gentzler, A.L., Fox, N.A., & Kovacs, M. (2008). Vagal tone and temperament as predictors of emotion regulation strategies in young children. *Developmental Psychobiology, 50*, 205-216. doi : 1002/dev.20283
- Schaefer, A., Nils, F., Sanchez, X., & Philippot, P. (2010). Assessing the effectiveness of a large database of emotion-eliciting films: A new tool for emotion researchers. *Cognition & Emotion, 24*(7), 1153-1172. doi:10.1080/02699930903274322
- Scheibe, S., & Carstensen, L. L. (2010). Emotional Aging: recent findings and future trends. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 65B*(2), 135-144. doi:10.1093/geronb/gbp132
- Schneider, S., & Stone, A.A. (2015). Mixed emotions across the adult life span in the United States. *Psychology and Aging, 30*, 369-382.

- Schryer, E., & Ross, M. (2013). Does the age-related positivity effect in autobiographical recall reflect differences in appraisal or memory? *Journals of Gerontology, Series B: Psychological and Social Sciences*, 69(4), 548-556.
- Scott, S. B., Sliwinski, M. J. & Blanchard-Fields, F. (2013). Age differences in emotional responses to daily stress: The role of timing, severity and global perceived stress. *Psychology and Aging*, 28, 1076-1087.
- Scott, S. B., Ram, N, Smyth, J. M., Almedia, D. M., & Sliwinski, M. J. (2017). Age differences in negative emotional responses to daily stressors depend on the time since event. *Developmental Psychology*, 53 (1), 177-190.
- Spielberger, C. D. (1989). *State-trait anxiety inventory: A comprehensive bibliography*. Consulting Psychologists Press.
- Thayer, J. F., & Lane, R. D. (2000). A model of neurovisceral integration in emotion regulation and dysregulation. *Journal of Affective Disorders*, 61(3), 201-216.
doi:10.1016/s0165-0327(00)00338-4
- Teachman, B.A., & Gordon, T. (2009). Age differences in anxious responding: Older and calmer, unless the trigger is physical. *Psychology and Aging*, 24, 703-714.
- Tsai, J. L., Levenson, R. W., & Carstensen, L. L. (2000). Autonomic, subjective, and expressive responses to emotional films in older and younger Chinese Americans and European Americans. *Psychology and Aging*, 15(4), 684-693.

- Tybur, J. M., Lieberman, D., Kurzban, R., & Descioli, P. (2013). Disgust: Evolved function and structure. *Psychological Review*, *120*(1), 65-84.
doi:10.1037/a0030778
- Wrzus, C., Müller, V., Wagner, G. G., Lindenberger, U., & Riediger, M. (2014). Affective and cardiovascular responding to unpleasant events from adolescence to old age: Complexity of events matters. *Developmental Psychology*, *49*(2), 384-397.
- Uchino, B. N., Birmingham, W., & Berg, C. A. (2010). Are older adults less or more physiologically reactive? A meta-analysis of age-related differences in cardiovascular reactivity to laboratory tasks. *Journals of Gerontology, Series B: Psychological and Social Sciences*, *65B*(2), 154-162. doi:10.1093/geronb/gbp127
- Uhrig, M. K., Trautmann, N., Baumgärtner, U., Treede, R., Henrich, F., Hiller, W., & Marschall, S. (2016). Emotion elicitation: A comparison of pictures and films. *Frontiers in Psychology*, *7*. doi:10.3389/fpsyg.2016.00180
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*(6), 1063-1070. doi:10.1037//0022-3514.54.6.1063
- Weschler, D. (1981). *Weschler Adult Intelligence Scale-Revised manual*. New York: Psychological Corp.
- Weschler, D. (1987). *WMS-R: Weschler memory scale-revised*. Psychological Corporation.

Wechsler, D. *Wechsler Memory Scale-Revised manual*. New York: Psychological Corp.

Williams, D. P., Cash, C., Rankin, C., Bernardi, A., Koenig, J., & Thayer, J. F. (2015).

Resting heart rate variability predicts self-reported difficulties in emotion regulation: A focus on different facets of emotion regulation. *Frontiers in Psychology*, 6. doi:10.3389/fpsyg.2015.00261

Zelazo, P., Cunningham, W. (2007). In J. Goss (ed.), Executive function: Mechanisms underlying emotion regulation. *Handbook of emotion regulation*. (pp.135-158). New York: Guilford

Appendix A: Tables

Table 1: *Comparison Between SAVI and DEA*

DEA Model (Kunzmann et al., 2017)	SAVI Model (Charles, 2010)
<ul style="list-style-type: none"> • Emotional preferences are based on developmental relevancy/usefulness. 	<ul style="list-style-type: none"> • Emotional preferences are based on whether a state/elicitor/event can be managed through one’s strengths, as well as not too encumbering on one’s limitations (i.e., physiological and/or cognitive).
<ul style="list-style-type: none"> • Relevancy/usefulness is the key factor. 	<ul style="list-style-type: none"> • Physiological arousal is the key factor.
<ul style="list-style-type: none"> • Older adults are less adept with anger because it is less developmentally relevant/useful. 	<ul style="list-style-type: none"> • Older adults are less adept with anger because it is physiologically taxing.
<ul style="list-style-type: none"> • Older adults are more adept with sadness because of its developmental relevance/usefulness. 	<ul style="list-style-type: none"> • Older adults are more adept with sadness because it is less physiologically taxing.

Table 2. *Younger and Older Adult Ratings for Selected Sadness, Anger, and Disgust Videos from the Pilot Study.*

Age group	Film	Emotion Label									
		Sad	Happy	Disgust (Moral)	Disgust (Contamination)	Irritable	Nervous	Upset	Angry	Scared	
Younger Adults	<i>21 Grams</i>	7.10 *	1.00	3.83	1.83	1.91	2.09	6.09	2.55	2.64	
	<i>Cry Freedom</i>	5.55	1.00	8.33 *	4.33	2.18	2.18	5.82	5.09 *	2.93	
	<i>Fear Factor</i>	2.18	1.00	7.17	8.50 *	4.64	3.18	3.90	2.73	2.14	
	<i>Lights Out</i>	1.55	1.778	1.67	2.11	2.33	4.11	2.44	1.78	4.33 *	
	<i>21 Grams</i>	7.08 *	1.07	1.25	1.00	2.86	3.07	5.36	5.36	1.76	
Older Adults	<i>Cry Freedom</i>	5.86	1.21	8.75 *	2.75	3.64	3.07	7.07	5.86 *	1.91	
	<i>Fear Factor</i>	2.36	1.07	5.25	8.50 *	5.59	2.57	5.50	3.36	1.89	
	<i>Lights Out</i>	1.6	1.10	1.90	2.3	2.80	3.30	2.20	1.60	3.50 *	

Table 3. Demographics, Affective and Cognitive Measures

		YA (n = 38)	OA (n = 24)	<i>t</i>	<i>p</i>
Gender	M/F	11/27	10/14	.	.
Age	<i>M(SD)</i>	20.7(4.71)	68.3 (6.47)		
Education	<i>M(SD)</i>	13.5(1.44)	17.4(3.04)	6.689	< .001
Subjective Health	<i>M(SD)</i>	1.95(0.613)	1.875(0.612)	.453	.652
Positive Affect	<i>M(SD)</i>	29.89(8.59)	39.43(5.467)	4.762	< .001
Negative Affect	<i>M(SD)</i>	18.02(6.26)	14.92(4.18)	-2.143	.036
CES-D	<i>M(SD)</i>	20.05(10.66)	9.79(4.74)	-4.436	< .001
STAI	<i>M(SD)</i>	42.68(11.10)	30.92(8.33)	-4.456	< .001
Cognition Composite	<i>M(SD)</i>	-.364(1.19)	.7274(1.64)	2.58	.038
Mental Control Task	<i>M(SD)</i>	21.24(4.05)	23.21(4.22)	1.71	.749
Mental Arithmetic	<i>M(SD)</i>	8.21(2.52)	10.16(3.66)	2.09	.014
Backwards Digit Span Task	<i>M(SD)</i>	5.82(1.35)	6.32(2.29)	.879	.004
Word Sum Task	<i>M(SD)</i>	44.21(14.68)	36.47(9.54)	2.39	.07

Table 4. Manipulation Check for the Video Ratings

Age group	Film	Emotion Label									
		Sad	Happy	Disgust (Moral)	Disgust (Cont.)	Irritable	Nervous	Upset	Angry	Scared	
Younger Adults	<i>21 Grams</i>	5.84	1.74	2.89	1.82	2.76	3.32	4.5	2.81	3.21	
	<i>Cry Freedom</i>	4.34	1.79	6.16	3.03	3.55	2.58	4.32	4.05	2.84	
	<i>Fear Factor</i>	2.00	2.92	5.16	7.13	3.66	2.79	2.92	2.05	2.76	
	<i>Lights Out</i>	1.42	2.63	1.68	2.03	2.76	4.24	2.74	2.08	4.95	
Older Adults	<i>21 Grams</i>	7.96	1.50	4.81	3.54	4.27	4.35	6.92	4.73	3.81	
	<i>Cry Freedom</i>	7.26	1.92	8.19	6.46	5.57	4.76	6.81	7.50	4.73	
	<i>Fear Factor</i>	3.84	1.92	5.655.65	6.92	5.57	4.04	5.65	3.65	4.04	
	<i>Lights out</i>	2.69	1.65	3.35	3.23	1.19	5.26	4.23	3.19	6.23	

Appendix B: Figures

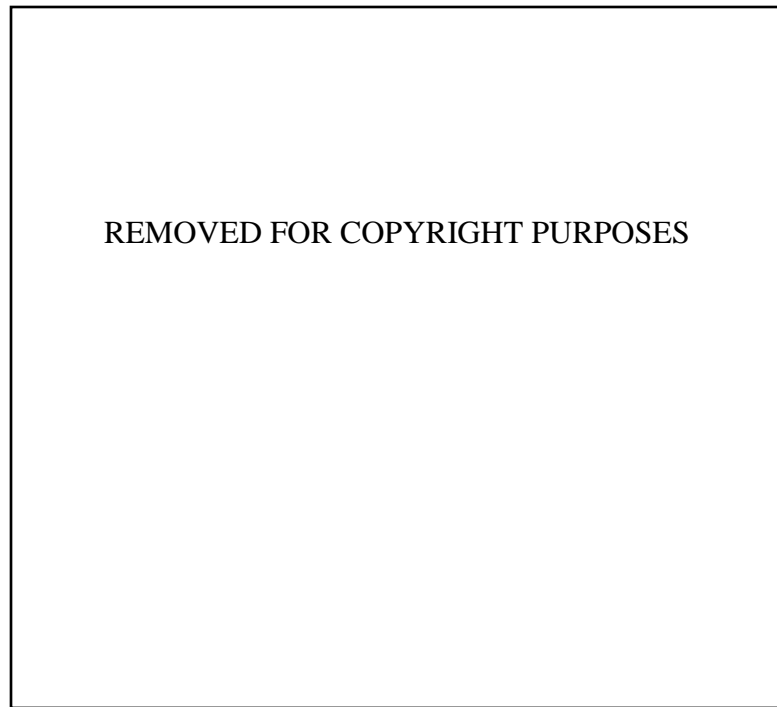


Figure 1. Schematic map of core affect. Retrieved from Russell & Barrett (1999).

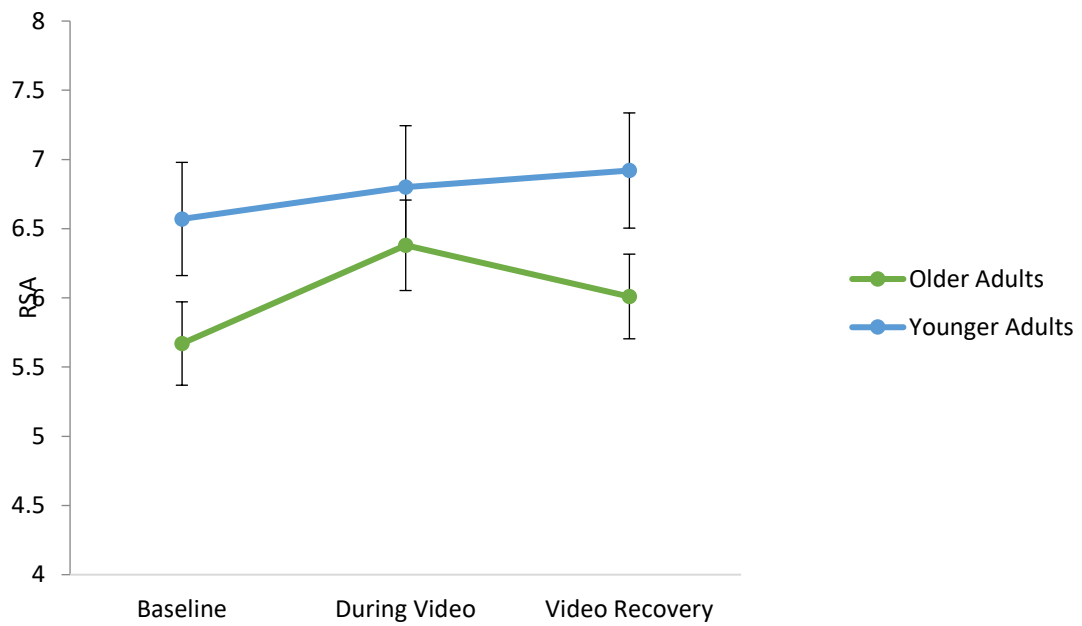
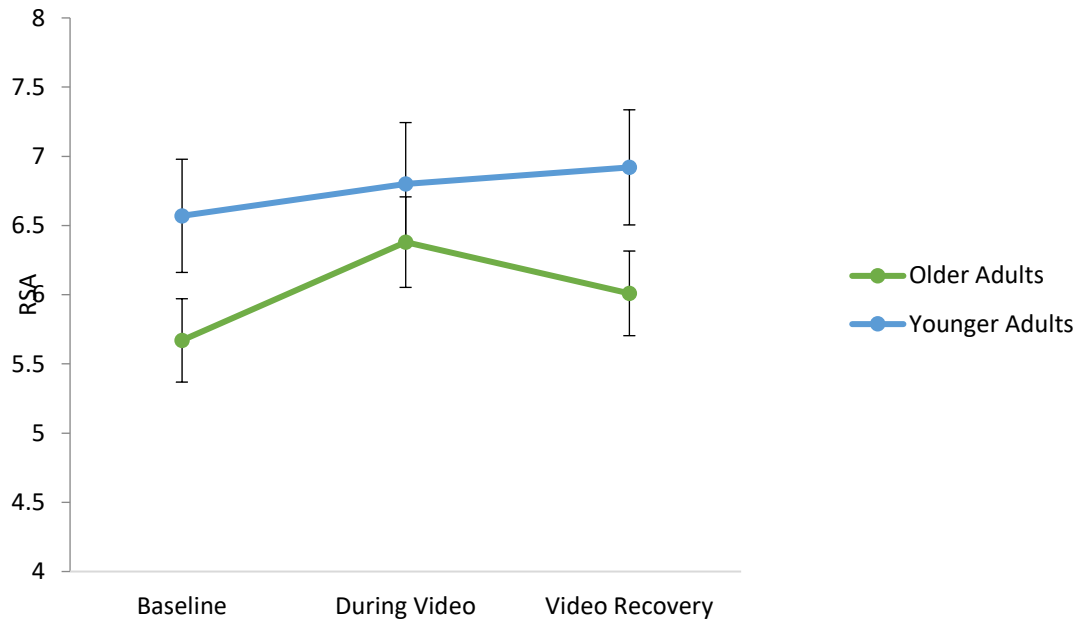


Figure 2. Across epoch changes in RSA for the sad video. Error bars represent standard errors of the mean.

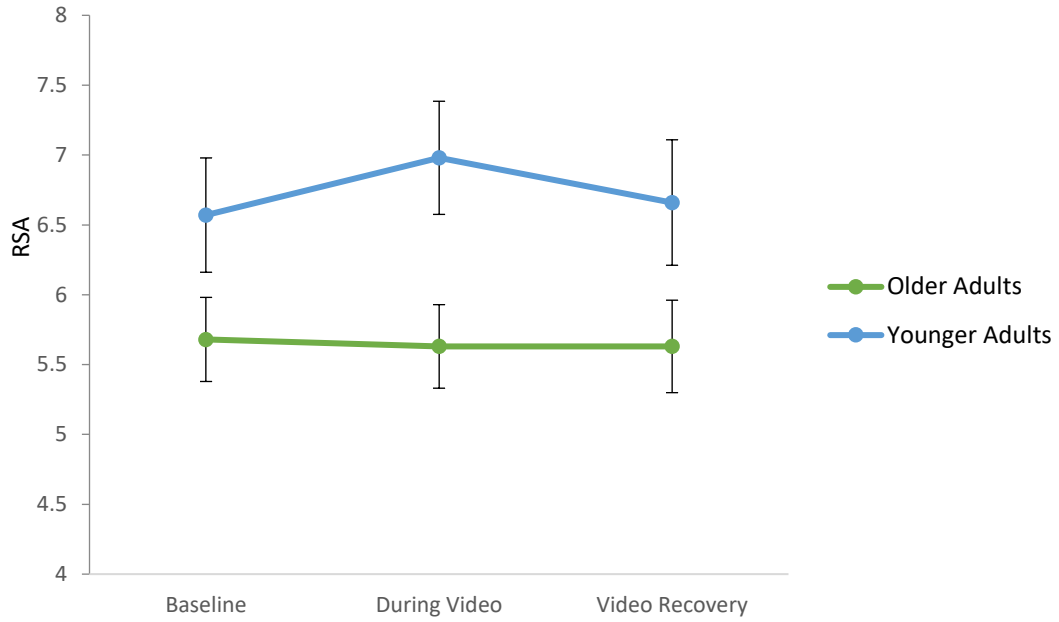


Figure 3. Across epoch changes in RSA for the anger video. Error bars represent standard errors of the mean.

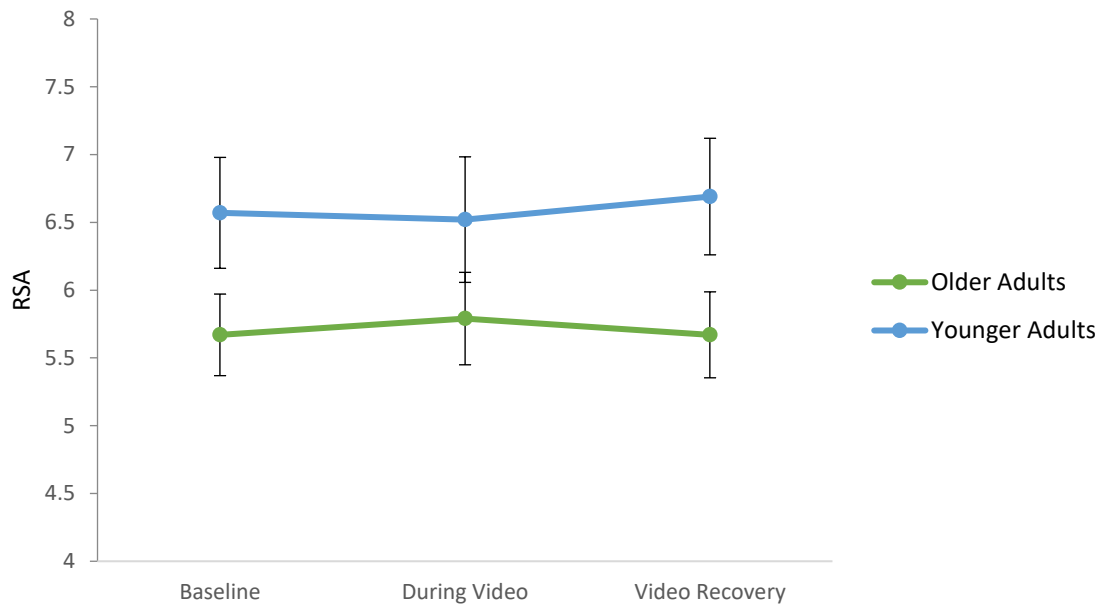


Figure 4. Across epoch changes in RSA for the fear video. Error bars represent standard errors of the mean.

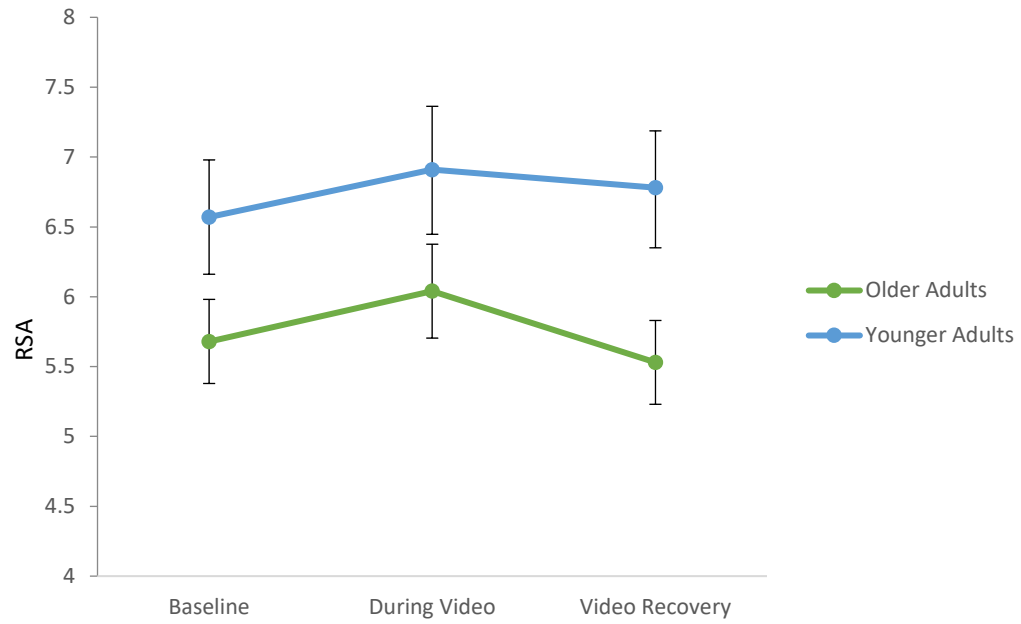


Figure 5. Across epoch changes in RSA for the disgust video. Error bars represent standard errors of the mean.

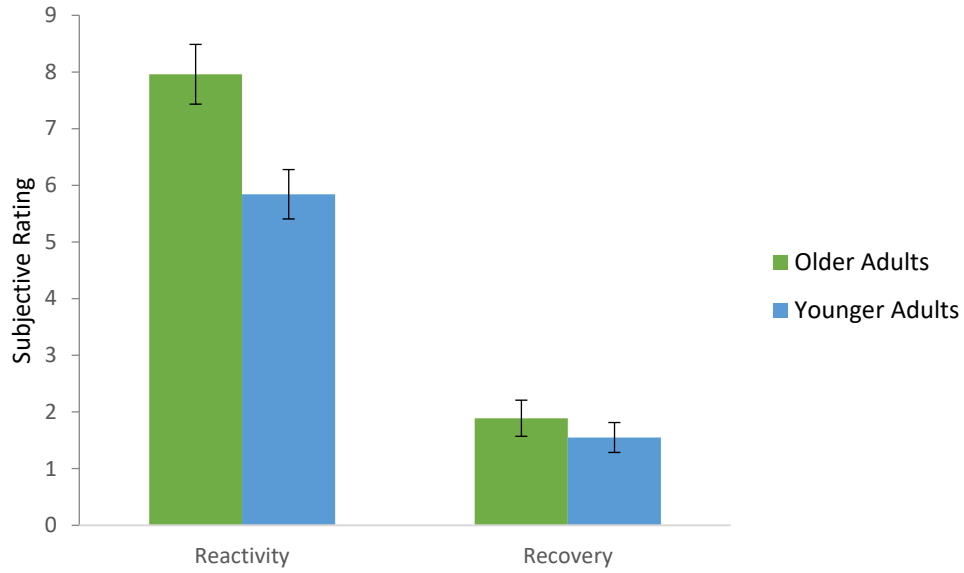


Figure 6. Subjective affect ratings for the sad video. Error bars represent standard errors of the mean.

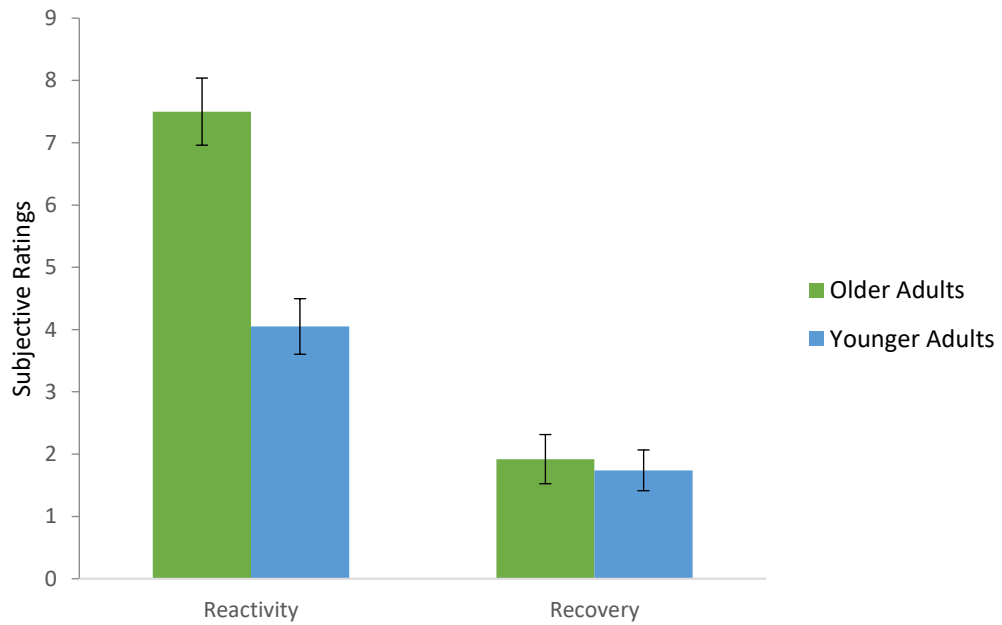


Figure 7. Subjective affect ratings for the anger video. Error bars represent standard errors of the mean

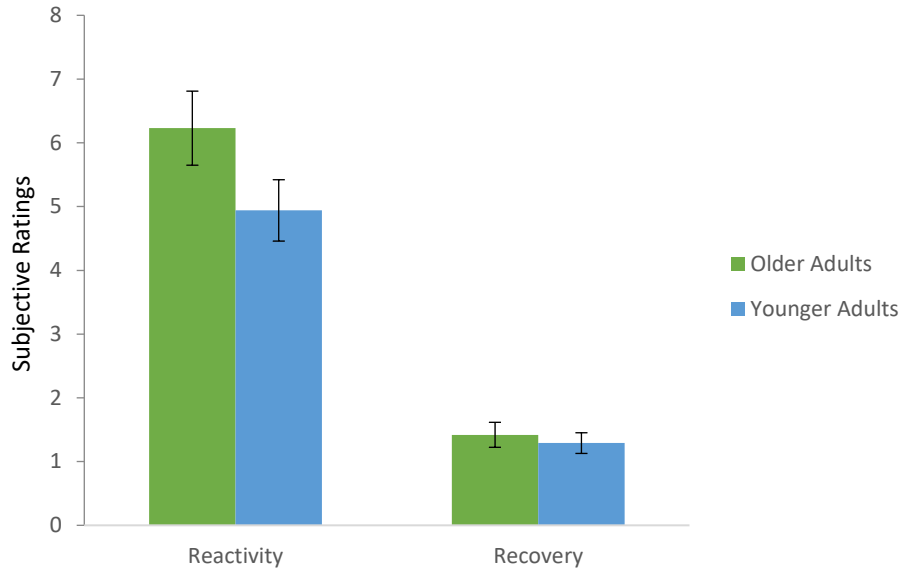


Figure 8: Subjective affect ratings for the fear video. Error bars represent standard errors of the mean.

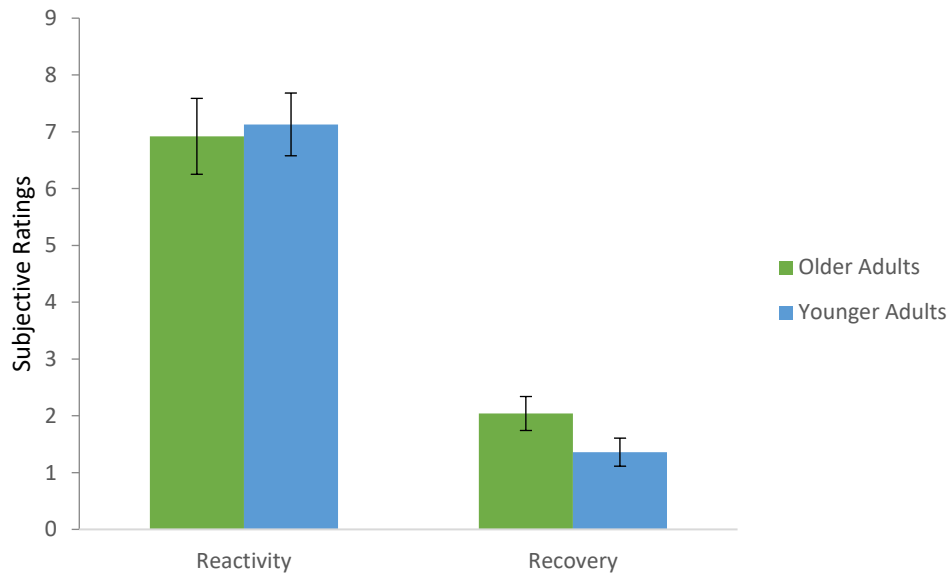


Figure 9. Subjective affect ratings for the disgust video. Error bars represent standard errors of the mean.