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Age Differences In Emotional Reactivity To Subtypes of Sadness And Anger

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AGE DIFFERENCES IN EMOTIONAL REACTIVITY TO SUBTYPES OF SADNESS

AND ANGER

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ABSTRACT

Emotional reactivity has been commonly studied through the discrete emotion

approach model (DEA) that categorizes emotions as singular unique experiences

(sadness, fear, disgust, anger, etc.). Reactivity to a discrete emotion is related to the

contextual relevance of the emotional elicitor, and thus, may result in variable reactivity

profiles across different age groups. While prior research has typically associated older

age with sadness and younger age with anger, there may be contextual subtypes within

these discrete categories that are more or less relevant to either age group. Characteristics

of older age are associated with themes of loss (death, diminished physical ability, etc.);

therefore, we predicted older adults would be equally or more reactive to loss-based

sadness compared to younger adults. In contrast, we predicted younger adults would have

greater reactivity to failure-based sadness, as younger adulthood is associated with

themes of resource competition. As prior research has found older adults to be less

reactive to interpersonal conflict compared to younger adults, we predicted younger

adults would be more reactive to frustration-based anger. Lastly, we predicted older

adults would be more reactive to violation-based anger, as older adults may be more

embedded in their moral values compared to younger adults. In this study, 49 younger

adults (M_{age} = 20.00, SD = 2.26) and 51 older adults (M_{age} = 66.00, SD = 4.94) were

asked to relive and verbally describe an emotional memory associated with subtypes of

anger and sadness. Emotional reactivity was recorded through self-reported ratings on

distinct emotion categories. Results revealed a significant age difference in emotional reactivity to violation-based anger. No other significant age differences were found. The findings from this study suggest that aging and emotional reactivity may be determined by contextual relevance within discrete emotions. Future research could potentially investigate emotional subtypes within other discrete categories, mixed emotion subtypes, and age differences in emotion regulation strategies within emotion subtypes.

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CHAPTER I

INTRODUCTION

Research regarding emotional aging has investigated age differences in reactivity

to emotional elicitors from various perspectives. Several studies have observed emotions

through a dimensional view wherein emotional experiences are measured on simple

valence categories (i.e., positive vs. negative). While this classification is useful, it does

not take into account the full contextual and utilitarian aspects of emotions. For instance,

while one might identify sadness as a negatively-valenced emotion, this does not mean all

sadness experiences are necessarily unpleasant. Similarly, other negatively-valenced

emotions, such as anger, may be a pleasant experience for an individual if the emotions

are practical and relevant to a situation. For this reason, a discrete emotions approach,

which identifies specific emotions (sadness, anger, fear, etc.) as unique experiences, is

more inclusive for determining the relevance and utility for individuals at various ages.

Functional emotion theories emphasize the adaptive value of discrete emotions in

which they provide useful information to the individual and others, as well as motivate

adaptive behaviors (Levenson, 1994). While the discrete emotions approach (DEA) takes

a functionalist perspective to understanding affective experiences, additional

considerations are necessary in terms of social, cultural, and biological influences that

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may have an effect on perceived relevance (Kunzmann, 2014). For example, individuals of different ages may react differently to a discrete emotion when the elicitor is more relevant to the cultural values associated with their age. More specifically, research has found that younger people are more motivated by goals associated with financial success compared to older adults (Nurmi, 1992) and, therefore, elicitors related to these goals are perhaps more stimulating for younger adults. Evidence from past research indicates that younger and older adults react to different emotions (such as anger and sadness) with differing intensities (Kunzman et al., 2017); however, there is little to no research exploring differences within a single discrete emotion when manipulating the contextual relevance of the elicitor.

While discrete emotions are often given a single label (sad, happy, anger, fear, etc), we can potentially subdivide these discrete states even further based on the contextual nature of the emotional elicitor. Dissecting discrete emotions further allows us to test if certain emotional categories are more nuanced than their fundamental labels. This study investigated potential age-related differences in reactivity between younger and older adults across subtypes of sadness and anger. These subtypes, identified as *loss-based* sadness, *failure-based* sadness, *violation-based* anger, and *frustration-based* anger, may further highlight how age-related relevance of discrete emotional categories influence emotional experience throughout adulthood and older age. With a growing population of older adults, research in emotional aging is important for understanding the psychological needs and complications that are specific to a rapidly expanding demographic.

Effects of Relevance on Emotional Reactivity

One way to conceptualize affective experience is through the discrete emotions approach (DEA; Ekman, 1971; Izard, 1991). Discrete emotions are defined as the basic and fundamental elements of emotions that exist as individually categorized entities such as anger, fear, joy, and so on (Harmon-Jones, 2017). The DEA model is based on a functionalist perspective suggesting that relevance of emotional stimuli is related to the adaptive value predicated on social and biological factors (Kunzmann, 2014). For example, the function of an emotion may be to eliminate a threat from one's environment (e.g., being disgusted by rotten food, a dangerous contaminant) and, therefore, avoiding the threat for survival. In this scenario, the discrete emotion of disgust involves the dimensions of valence (unpleasant) and arousal (high) but also incorporates the utility of the emotion as an evolutionary benefit for the individual's health and well-being. Discrete emotion concepts take into account the motivating factors involved in the emotional appraisal process.

The function of an emotion will vary based on an individual's situational needs and what may be appraised as relevant. Relevance is defined in this study as a stimulus' informativeness to a goal, whereby the appraisal of relevance can significantly influence the intensity of the emotional reaction, as reflected in self-reported and autonomic responses (Olteanu, 2019). In other words, the more relevant an individual identifies an elicitor, the more immersive the experience may be. The degree of relevance is dependent on numerous factors such as culture, gender, race, socioeconomic status, personal history, and age (Baltes, Linclenberger, & Staudinger, 1998). Using age as an example, younger adults may be more pressured to pursue resources for survival, such as money and social

success, whereas older adults are more likely to have accumulated resources and are, therefore, not as inclined to worry about achieving success to the same degree; instead, older adults may be more concerned with issues such as maintenance (e.g., functional status, health, current relationships, etc.; Nurmi, 1992).

From this perspective, there is evidence to suggest younger and older adults vary on their emotional reactions in relation to motivational features of affective episodes. For instance, the discrete emotion of anger may be more useful for achieving success (particularly when an impediment to success/important goal is present). Evidence in line with this assumption comes from Kunzmann and colleagues (2014; 2017) observing that younger adults tend to experience anger at a greater frequency and intensity than older adults (who presumably are less motivated to engage in confrontational pursuits). Other related research has focused on age differences in emotion regulation strategies to anger with results suggesting older adults are more inclined to deploy passive and avoidant approaches when experiencing anger elicitors (Blanchard-Fields & Coats, 2008). Blanchard-Fields & Coats also found that older adults reported experiencing less anger in their daily lives, which partially explained the use of less proactive regulation strategies.

While a younger adult age is associated with a greater inclination toward confrontation pursuits, older age is often characterized by themes of loss and decline, which could lead to motives related to preservation and maintenance. This, in turn, could lead to an active attempt toward "living in the present" and creating emotionally meaningful experiences (Carstensen, 2006). Thus, older adults may be more familiar and comfortable with experiencing sadness as adaptive for signaling the need to obtain support and sympathy (Andrews & Thomson, 2009). Prior research on age differences in

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emotional reactivity to sadness has shown older adults to be equally or more reactive to sadness elicitors compared to younger adults (Seider, 2011; Kunzmann 2014; Kunzmann et al. 2017; Lohani, Payne & Isaacowitz, 2018). A study of emotional reactivity to sadness elicited by a film depicting the loss of a loved one resulted in a significant difference in subjective self-reported sadness in which older adults reported higher rates of sadness compared to younger adults (Kunzmann, 2005). In a 2017 study by Kunzmann and colleagues, results revealed that older adults were equally or more reactive to sadness prompts compared to younger adults. Other research focused on emotional coherence (the correlated and synchronized response patterns to an elicitor) has found that older adults have greater emotional coherence in response to sadness as compared to younger adults (Lohani, Payne & Isaacowitz, 2018). More specifically, older adults' behavioral, experiential, and physiological responses were more collectively attuned to sadness elicited by video clips compared to younger adults. With consideration of these findings, it is conceivable that age groups may react differently to the same emotional elicitor because of adaptive utility and relevance.

While the DEA model considers utility and relevance when determining an individual's emotional reactivity, some features are less established. Despite prior research observing age differences in emotional reactivity to discrete emotions, results are equivocal. While certain studies have found that the frequency of sadness remains stable over most of adulthood (Kunzmann et al. 2013; Tsai, Levenson & Carstensen, 2000), other research has observed increases in sadness reactivity with advanced age (Lohani & Isaacowitz, 2014; Phillips et al. 2008). For anger, research has shown older adults to be less reactive to anger prompts when compared to younger adults (Kunzmann

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et al. 2017), while a recent study from our lab showed an opposite pattern (Lautzenhiser, 2019). One possibility for the discrepant findings across studies could be due to the potential "subtypes" of specific discrete emotional categories being elicited. While sadness and anger are distinct emotional categories, there could be sub-dimensions within these broader categories that could produce elicitors/contexts that hold differential value for younger and older adults. For example, the disappointment of not getting a job or accepted into a prestigious undergraduate or graduate program may be a more provocative sadness trigger for younger adults compared to older adults. However, the death of a loved one or loss of an important friend (i.e., break up or divorce) could be quite evocative, regardless of age. Essentially, the DEA model could be probed further to subdivide distinct emotion categories into age-relevant components. We assessed these contextual differences within discrete categories as emotional subtypes that derive from basic discrete emotions. Perhaps subtypes within these discrete emotion categories are associated with more specific contexts that are of greater salience to younger and older adults.

Subtypes of Sadness and Anger

When investigating subtypes of discrete emotions, research has identified fundamentally different types of disgust (moral and contamination; Yoder et al., 2015), as well as different types of anger (threat, frustration, righteous indignation; Frick, 1986). Similarly, discrete sadness has been subdivided into additional categories. For example, Shirai and Suzuki (2015) examined verbal, physiological, and self-reported responses to sadness associated with loss of a family member and sadness associated with failure to achieve a goal. Results revealed significant differences in terms of physiological and

subjective responses to these subtypes. For instance, loss-based sadness was associated with a more aroused subjective and physiological profile, with failure-based sadness associated with diminished physiological arousal but more expressive external behavior.

Beyond autonomic responses, Shirai and Suzuki (2018) further investigated the characteristics of loss-based and failure-based sadness from the perspective of internal encoding. The researchers tested differences in word and verbal associations with both types of sadness as well as features of the verbalized expression of sadness subtypes. The goal was to examine if the external expression of failure-based sadness was more or less dynamic than loss-based sadness. The results showed that verbal expression of loss-based sadness was more static while the verbalization of failure-based sadness was more dynamic (Shirai, 2018). The researchers further hypothesized that the expressive and internalized features of loss-based sadness are congruent with self-soothing functions while the features of failure-based sadness are more indicative of requesting for help, further suggesting a significant distinction within the discrete emotion of sadness.

These findings serve as evidence supporting the claim that sadness contains two subtypes that are characterized by both autonomic responses and internally conceptualized cognitive and behavioral patterns. To fundamentally differentiate the two sadness subtypes, the underlying conceptual difference between loss-based and failure-based scenarios is the degree of situational autonomy. A scenario in which an individual loses something to forces that are beyond their control (i.e., the death of a family member) will be characterized as loss, while a situation in which the individual has more autonomy and is unable to achieve their desired goal (i.e., getting fired from a job) would be characterized as failure. These subtypes of sadness can be further examined by their

associations with specific demographic and situational contexts that frame them within the DEA model, suggesting adaptive functionality of these subtypes (Beck, el al., 1983). Young adulthood has typically been described as a phase of growth, where development and optimization have priority over maintenance and compensation (Ebner et al., 2006). This orientation toward future goals may result in greater sensitivity to failure. Older age can be characterized by themes of loss and decline, and therefore, irreversible losses may be equally or more salient with advanced age (Kunzmann et al. 2014).

Age differences in emotional reactivity to anger have similarly been investigated, but results have been inconsistent. Prior research has found that older adults tend to react less to anger elicitors compared to younger adults because, according to the DEA, anger is less adaptive and perhaps more physiologically taxing (Kunzmann et. al., 2017). This, however, is only evident when looking at one type of anger elicitation context. For instance, anger could be subdivided within various themes, including frustration or moral virtue. The latter case could be considered "violation-based anger," which can be defined as a perceived injustice or violation of one's morals. Frustration-based anger is best defined as an inability to change or control something of significance. One recent study from our lab investigated age differences in emotional reactivity and found that older adults had significantly higher reactivity to an anger elicitor compared to younger adults (Lautzenhiser, 2019). These results can potentially be explained by the nature of the elicitor in that study and the degree of relevance it had on the participants involved. The content of the video elicitor used depicted moral violations and was perhaps more relevant to older adults, which could cause a significant difference in results between the two studies. Prior research suggests that older adults judge perceived moral violations

less leniently compared to younger adults and are more likely to have a greater emotional reaction to morally debatable behavior (Jiang, Li & Hamamura, 2015). In contrast, other research has observed that older adults are less reactive to anger compared to younger adults when the goal is to assess perceived interpersonal transgressions (Kunzmann et al. 2017). The rationale is that younger adults are more likely to come across frustrating day-to-day troubles as they compete for resources, whereas older adults are perhaps more focused on bigger picture problems such as violations of justice or moral values.

While sadness subtypes can be differentiated by perceived situational autonomy, anger subtypes can be differentiated by perceived situational *proximity*. To clarify, a frustration-based anger elicitor will be perceived as an immediate threat that directly affects the subject (i.e., being stuck in traffic while late to a meeting). Older adults are more likely to use avoidant behaviors to eliminate frustration elicitors from their environment (Blanchard-Fields, Jhanke, & Camp, 1995) and are more likely to attend to more positive aspects of a situation compared to younger adults (Reed & Carstensen, 2012), which may lead to age differences in frustration-based emotional reactivity. A violation-based anger elicitor is more abstract and indirect to the subject but could violate internalized values.

A theoretical reasoning for these specific subtypes and age associations can be attributed to the desire for preservation of cultural values and norms with advanced age. Terror management research has shown that death reminders lead to increased adherence to, and defense of, one's cultural worldview (Maxfield et al., 2007). Further research in existential psychology has found that individuals can achieve death acceptance by establishing meaning through their cultural and ethical values (Wong, 2008). As

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proximity to death becomes more salient for older adults, a desire to preserve their established beliefs and legacy for the future generations becomes more significant (Major & Whelton, 2016); therefore, we could perhaps expect older adults to be more reactive to violation-based anger elicitors.

Present Study

The present study assessed emotional reactivity to subtypes of anger and sadness to determine potential age differences within single discrete emotions based on relevant contexts. To achieve this, participants were asked to relive and type out an emotional memory related to each emotional subtype and were then asked to rate their emotional reactivity through a self-reported measure. The results of this study could provide insight into emotional aging as well as expand our current understanding of the DEA model. The DEA model suggests that individuals experience and utilize unique emotional events that can be categorically identified. While prior research has investigated age differences in emotional reactivity to discrete emotions, the results have been indeterminate with no clear conclusion on how age groups may actually differ. Therefore, this study aimed to determine if age differences exist within subcategories of these discrete emotions: more specifically, frustration-based and violation-based anger, as well as loss-based and failure-based sadness.

Subtypes within discrete emotions can potentially explain the inconsistent results of prior research. The DEA model applies a relevancy viewpoint that suggests individuals are more adept with emotions that are adaptive for effectively managing age-specific developmental opportunities and constraints (Kunzmann & Wrosch, in press). If the elicitor used in an experiment is only relevant to a single age group, it may result in

biased reactivity ratings. For this reason, this study investigated how subtypes within the discrete emotions of anger and sadness may differ across age groups. This can help expand our understanding of how emotions function and the limitations of the current DEA model.

The present study further elucidated our understanding of emotional aging. The results of this study could expand knowledge of whether life span trajectories of emotional reactivity are stable or adaptive and what specific factors might predict adaptive emotional responses within age groups. More specifically, this study could add to the significance of relevance appraisal in emotional aging theories. This information could be used to inform interventions for improving life quality for older adults.

Predictions

If we consider the effects of relevance on emotional reactivity based on contextual subtypes within discrete emotions, we expected significant differences across age groups. More specifically, we predicted that younger adults would be more reactive to failure-based sadness relative to older adults while older adults would be more reactive (or equally reactive) to younger adults when confronted with loss-based sadness. The reasoning for this was based on a few assumptions about the context that is most relevant to each age group. While everyone experiences loss and failure throughout their lives, each experience may hold variable significance based on several social and biological factors (Keltner, Haidt & Shiota, 2006). Younger adults are more frequently in pursuit of resources (financial, material, social), while older adults typically have established their lives and feel more satisfied with their goals (Nurmi, 1992). This may suggest that failure elicitors are more salient in the lives of younger adults as compared to older adults.

Conversely, loss-based sadness may result in greater reactivity from older adults (or comparable to younger adults), as themes of loss are typically more relevant in older age (Kunzmann, 2005).

For anger, we predicted that older adults would have greater emotional reactivity to violation-based anger compared to younger adults. Older adults may be more focused on their desire to preserve their culture and ethical values compared to younger adults because they have established their values more fervently and want to develop and uphold their cultural beliefs as a means of generativity (Major & Whelton, 2016). Further rationale for this prediction was based on research suggesting older adults may find public events of injustice more relevant and emotionally arousing than their younger counterparts (Charles, 2005), which may hold true for moral violation-specific elicitors. In contrast to violation-based anger, we predicted that younger adults would be more reactive when confronted with frustration-based anger relative to older adults. This prediction was based on prior research showing that older adults are less reactive to frustration/goal impediment forms of anger when compared to younger adults (Kunzmann et al. 2017). A further rationale was that younger adults may be more likely to utilize frustration-based anger to achieve goals that are more relevant within their lives, such as competing for resources (Nurmi, 1992; Olteanu, 2019). Below is a summary of the aforementioned predictions:

CHAPTER II

METHODS

Participants

A power analysis conducted using G*Power determined that for a moderate effect size (f =.125), a Type 1 error rate of .05, and a statistical power of .80, a total of 90 participants were necessary for this study: 45 older adults (ages 60-85) and 45 younger adults (ages 18 to 35). However, due to oversampling, we recruited 66 older and 75 younger adults. We excluded 14 older adult participants and 26 younger adult participants who failed to properly complete the study and adhere to instructions. One older adult participant was excluded for having a history of neurological disorder. Our final sample comprised 51 older adults (M_{age} = 66.00, SD = 4.94) and 49 younger adults (M_{age} = 20.00, SD = 2.26). The overall ages ranged from 18-32 for younger adults and 60 to 89 years old for older adults. The younger adult sample had 6 males, 42 females, and one individual who identified as non-binary. In comparison, the older adult sample had 31 males and 20 females. Younger adults were recruited through the Cleveland State University SONA participant database. Older adults were recruited through established participant databases, local senior centers, Project 60, social media, and Amazon's Turk

Prime. The participants were compensated with either research credit or a monetary reward ($10/hr.) for their participation.

Measures

Emotion Elicitation

Participants performed a "relived emotion" and "think-aloud" task that required the recollection of a life event that elicited feelings of "loss," "failure," "frustration," and "violation." Loss-based memories could follow the theme of losing a significant person in their life (i.e., death of family member or friend), while failure-based memories could follow the theme of feeling deficient in an important life domain (i.e., being fired from a job, not getting into a particular school program, losing a competitive game, etc.). Frustration-based memories could follow the theme of an impediment to a blocked goal (i.e., being stuck in traffic, getting into a heated argument, having a possession stolen, etc.) while an example of a violation-based memory could follow the theme of witnessing some infringement on one's morals or values (i.e., witnessing a legal miscarriage of justice, viewing an opposing political ad, attacks on one's religious beliefs, etc.). The eliciting memory needed to be autobiographical in nature and emotionally significant to the participant.

Self-Reported Affect

To determine levels of emotional reactivity across the four memory conditions, a self-reported affect measure, similar to one used by Kunzmann, et. al. (2017), was employed with some modifications based on the elicitation tasks for the present study. Participants rated their level of subjective emotionality across specific affect categories. Measures were taken both prior to engaging in the reliving and think-aloud tasks as well

as after those tasks. A list of 15 emotional adjectives were rated on a continuous sliding scale from 0 (not at all) to 10 (extremely). A pre-study conducted prior to the main study determined groups of affect-related adjectives associated with each subtype. Four adjectives were related to loss (hopelessness, regret, loneliness, and despair), three failure-related adjectives (guilt, shame, and defeat), two frustration-related adjectives (annoyance and irritation), and three violation-related adjectives (outrage, disapproval, offended). Three non-sadness and non-anger-based affect terms were also included (fear, disgust, happiness). These associated adjectives were generated from relatedwords.org, which uses an algorithm based on word embedding to convert words into many dimensional vectors that represent their meanings. The vectors of the words in the query are compared to a large database of pre-computed vectors to find similar words. The top affect-related words were chosen for each subtype, rather than just direct synonyms.

Individual Differences Measures

Several individual difference measures could reveal certain variables that covary with the main variables of interest for the present study. These measures include the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977), State Trait Anxiety Inventory (STAI) (Spielberger, et al., 1983), and the Satisfaction with Life Scale (SWLS) (Diener, et al., 1985) to account for depressive and anxiety symptomatology, atypical mood states, and general life satisfaction, respectively. We included a stressful life events questionnaire (adopted from the Social Readjustment Rating Scale (Holmes & Rahe, 1967) as a manipulation check for the type and severity of the memories selected by each age group. This information can be indicative of any possible alternative factors that may affect our results. A COVID-19 well-being questionnaire was also included to

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assess pandemic-related covariates (Barber & Kim, 2020). We wanted to account for the possibility that this historically embedded event could have potentially influenced participants' affective repertoires in a way that is distinct from age-related emotional profiles prior to the pandemic, as the present study's hypotheses were based on behaviors/preferences observed in a pre-COVID milieu.

Additional Measures

This study included a time measure in which participants were asked how many years had passed since the events in the selected memory had occurred. Participants could answer at minimum less than one. This was included to determine if there were any time effects on their emotional reactivity. Participants were also asked to rate on a 0 - 10 range sliding scale how impactful this event was on their life. This was used as a salience measure to measure how significant the emotional memory was for the participant. At the end of each subtype type-out memory task, participants were asked how successfully they were able to access the emotional aspects of their memory.

Procedure

The entire protocol was administered online through Qualtrics. Participants first provided informed consent after reading through a brief explanation regarding the basic study protocol. Prior to the main tasks, participants completed a first round of the 7-item affect measure. Participants were then informed as to the nature of the reliving and typed-out tasks. The order of recalling loss, failure, frustration, and violation events were counterbalanced across participants. Participants were provided examples of memories that could be considered loss, failure, frustration, or violation based.

Instructions for the re-living and typed-out tasks were akin to those described in Kunzmann et al. (2017). For the re-living task, participants were told to think about the specific event and focus on the moment at which the specific emotion (e.g., loss-sadness) was most salient, outside of any other emotion. More specifically, participants were asked to identify a memory that was emotionally impactful and significant in their life and were provided examples, then they were asked to fully "get into" the emotional aspects of that memory. Once the memory had come to mind, participants were cued to begin mentally reliving the selected memory for 30 seconds. After the 30-second period, participants completed another assessment of the 15-adjective emotion self-report measure. Next, participants were asked to type out the selected memory, as if telling it to a friend. Participants were given two minutes to type out the event by including any details that the participant deemed important and relevant. This was then followed by another administration of the 15-adjective emotional self-report.

Participants then watched a neutral video for 30 seconds as a wash out period prior to completing the re-living and typed-out tasks for the second memory. The same instructions were provided for the re-living and typed-out tasks for the subsequent memories. Upon completion of the remaining conditions, participants were fully debriefed and compensated for their time. The entire protocol lasted no more than 60 minutes.

CHAPTER III

RESULTS

This study collected various demographic and individual difference variables to be utilized as potential covariates in the main omnibus analyses. A series of independent samples t-tests were performed on the demographic and individual differences data. Results (Table 1) revealed that younger adults had significantly higher depression (CES-D) and trait anxiety (STAI) scores compared to older adults (ps < .001). Younger adults scored higher than older adults on the stressful life events social readjustment scale (SRRS) (p = .01). In addition, older adults reported a higher level of completed education compared to younger adults (p <.001). No other significant age differences emerged from the other demographic and individual difference measures. All measures denoting significant age differences (CES-D, STAI, SRRS, and education) were initially included as independent covariates in the main omnibus analysis; however, the results were no different when comparing between analyses with and without the covariates; therefore, all analyses reported for self-reported affect do not include covariate measures.

Table 1. *Demographics and Individual Differences*

	YA ($n = 49$)	OA ($n = 51$)	t	p
Gender (M/F/O)	6/42 /1	31/20	.	.
Age $M(SD)$	20.14 (.39)	66.31 (.49)	.	.
Education $M(SD)$	13.73 (1.55)	15.84 (2.88)	-4.531	<.001
Self-Reported Health $M(SD)$	1.82 (.76)	2.17 (.89)	-1.848	.069
CES-D $M(SD)$	18.29 (10.7)	10.19 (8.81)	3.832	<.001
STAI $M(SD)$	44.14 (10.92)	31.65 (11.38)	5.084	<.001
SWLS $M(SD)$	22.80 (6.81)	25.52 (6.61)	-1.860	.066
SRSS $M(SD)$	157.8 (81.25)	105.5 (95.8)	2.643	.010
COVID-19 $M(SD)$	3.56 (1.17)	3.86 (1.08)	-1.181	.12

Self-Reported Affect

To determine if the self-report measure for this study would be valid and reliable, we conducted a brief pre-study in which 20 participants (10 older adults and 10 younger adults) were assigned to 1 of 2 versions of the study. In one version, the self-reported ratings consisted of 15 itemized affect-related adjectives. In the other version, the same affect related adjectives were rated in groups that corresponded to each emotion subtype. A factor analysis was performed to determine which adjectives loaded most effectively onto each factor. Four factors were extracted and represented each subtype. These factor loadings were used to determine the most effective group ratings for self-reported affect (Table 2). Loss comprised 4 items [hopelessness ($r = .763$) loneliness ($r = .928$), regret (r

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= .793) and despair (r = .815)], none of which loaded more than .421 on any other factor.

Violation comprised three items [outrage (r = .801), disapproval (r = .741), and offended

(r = .913)], none of which had a loading greater than .475 on any other factor. Frustration

comprised two items [annoyance (r = .912) and irritation (r = .942)] and loaded no higher

than .265 on any other factor. Lastly, Failure comprised three items [guilt (r = .758),

shame (r = .957), and defeat (r = .484)]. While defeat was below the .5 level, it loaded

the highest onto the Failure factor with the next highest loading being Loss (r = .370).

Table 2. *Rotated Component Matrix for Self-Reported Affect Sub-study*

Component

	Loss	Violation	Frustration	Failure
Hopelessness	0.763	0.397	0.084	0.218
Guilt	0.471	-0.159	0.034	0.758
Annoyance	-0.102	0.265	0.912	0.112
Outrage	0.132	0.801	0.387	-0.261
Regret	0.793	-0.127	0.068	0.421
Shame	0.104	0.02	0.06	0.957
Irritation	0.057	0.249	0.942	0.041
Disapproval	0.126	0.741	0.475	0.077
Loneliness	0.928	-0.126	0.003	-0.026
Despair	0.815	0.333	-0.102	0.327
Defeat	0.37	0.002	0.401	0.484
Offended	-0.045	0.913	0.079	-0.002

Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax
with Kaiser Normalization. Rotations converged in 7 iterations

For the main omnibus analysis, we conducted a 2 (Age Group: younger and older)

x 2 (Task: relive and type-out) x 4 (Subtype: loss, failure, frustration, and violation)

multivariate analysis of variance (MANOVA) with self-reported affect as our main

outcome variables. There was no overall significant main effect of Task, $F(1,98) = .343$, $p = .558$, $\eta_p^2 < .001$ Analyses revealed a significant main effect of Age, $F(1, 98) = 2.798$, $p = .039$, $\eta_p^2 = .003$, and Emotion Subtype $F(1,98) = 11.410$, $p < .001$, $\eta_p^2 = .011$. These main effects were qualified by an Age x Subtype interaction, $F(1,98) = 4.425$, $p = .035$, $\eta_p^2 = .001$. As predicted, post-hoc analyses on the interaction revealed there was a significant age difference in emotional reactivity to violation-based anger, $F(1, 98) = 15.33$, $p < .001$, $\eta_p^2 = .135$, where older adults ($7.08 \pm .43$) reported greater violation reactivity compared to younger adults ($3.94 \pm .50$).

We further examined potential age differences for the remaining subtypes. While older adults ($5.3 \pm .49$) rated loss-based sadness as higher than younger adults ($4.4 \pm .49$), this difference was not statistically significant, $F(1,98) = 1.742$, $p = .190$, $\eta_p^2 = .017$. For failure-based sadness, younger adults ($4.51 \pm .41$) had higher ratings than older adults ($3.87 \pm .52$); however, this difference was not statistically significant $F(1,98) = 1.203$, $p = .275$, $\eta_p^2 = .012$. Finally, for frustration-based anger, no significant age difference emerged, $F(1,98) = .694$, $p = .162$, $\eta_p^2 = .020$, but ratings were in the predicted direction: younger adults ($6.76 \pm .37$); older adults ($5.92 \pm .46$).

Figure I

Age Differences in Emotion Reactivity to All Sub-types
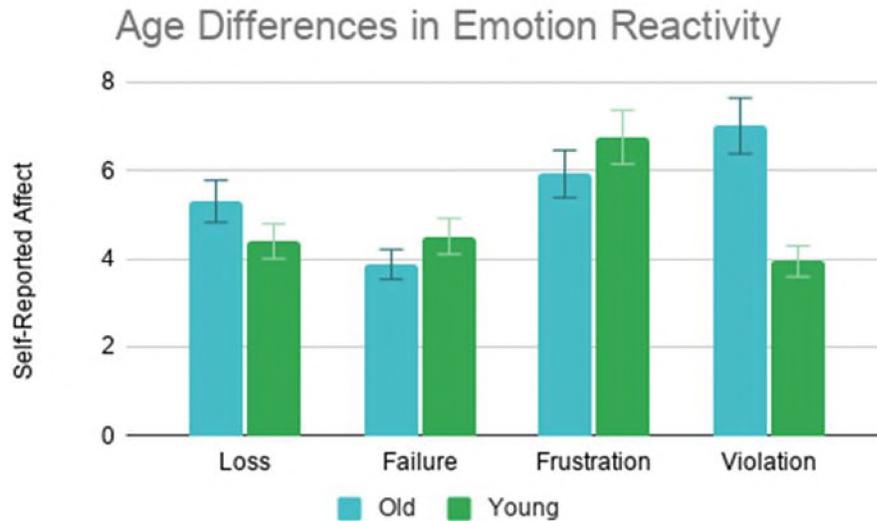
Additional post-hoc analyses were conducted to determine if the highest rated emotion labels for each condition corresponded with the condition type (i.e., loss ratings were highest during the loss condition). These results determined that loss was rated significantly higher than the other emotion labels during the loss condition for both older and younger adults (ps <.001). Similarly, frustration was rated significantly higher than the alternative emotion label choices during the frustration condition for both age groups (ps <.001). Likewise, older and younger adults rated violations significantly higher than all other emotion labels during the violation condition (ps < .001). Failure was found to be rated significantly higher than all other emotion labels during the failure condition for both age groups (ps <.001), with the exception of frustration, whereby frustration scores were not significantly different from failure scores for both older (3.57 ± .52) and younger adults (4.24 ± .48) (p = .436 and p = .296, respectively).

CHAPTER IV

DISCUSSION

The primary aim of this study was to determine if age-related contextual relevance to an emotional elicitor, as defined by discrete emotional subtypes, would result in age differences in emotional reactivity. Prior research has typically associated older age with greater reactivity to sadness, while in contrast, younger adult age is associated with greater reactivity to anger (Kunzman et al., 2017). These associations are predicated on the assumption that sadness is more relevant and optimal for characteristics of older age while anger may be more optimal when considering the context of younger age. More specifically, older age is characterized by themes of loss, such as physical decline, loss of loved ones, or loss of time. This overarching theme of loss may utilize an adaptive form of sadness to manage. In contrast, young adulthood is characterized by themes of competition and growth (Ebner et al., 2006), a context that may require anger as an adaptive emotional strategy.

The aforementioned distinction between younger/older and anger/sadness has not been conclusive. For instance, additional research has observed older adults to be more reactive to anger elicitors compared to younger adults (Lautzenhiser, 2019). Furthermore, prior research has shown that older adults are not always more reactive to sadness

elicitors compared to younger adults with often equal reactivity when comparing between these age groups (Seider, et al., 2011). Considering the effects of relevance appraisal on emotional reactivity, it is possible that different reactivity profiles could emerge between younger and older adults when discrete emotions are broken down even further. The current study attempted to dissect discrete emotions (sadness and anger) into subtypes (loss, failure, frustration, and violation) to further probe the role of relevancy in emotional aging.

As predicted, older adults were significantly more reactive to violation-based anger compared to younger adults. Prior research has found that older adults are typically more established in their values and moral beliefs compared to younger adults and may be more inclined to uphold these cultural values (Major & Whelton, 2016). Additionally, prior research has suggested that older adults find public displays of injustice more emotionally arousing when compared to younger adults (Charles, 2005). More recent research suggests that older adults judge perceived moral violations more harshly than younger adults and are more likely to have a greater emotional reaction when witnessing morally questionable behavior (Jiang, Li & Hamamura, 2015). Thus, the present results could signify that older adults may find moral violations more salient than younger adults and, therefore, respond with greater emotional reactivity.

While there were no significant age differences to loss-based sadness, older adults had a higher mean score to loss-based sadness than younger adults. This is not too surprising as prior research has either observed older adults to be more reactive to loss-based sadness, or younger adults' reactions are on par with those of older adults. Older age is typically characterized by themes of loss and, therefore, we expected loss to be

more relevant and salient with older age (Kunzmann, 2005); however, loss (particularly interpersonal loss) should be universally salient at any age. Younger adults are not immune to loss-based sadness, as subjects such as death are highly emotional and appraised as such regardless of age (Aldwin, 1996). Moreover, research has found that older adults are not always more reactive to sadness, and times when higher reactivity is observed among older adults is mostly reflected in self-report measures. Oftentimes, age groups are equivalent in reactivity when analyzing physiological arousal and expressive behavior (Seider, et al., 2011; Kunzmann, 2014).

Results regarding failure-based sadness and frustration-based anger revealed no statistically significant age differences. While the mean scores for both conditions were in the general direction we predicted (younger adults had greater reactivity to both conditions compared to older adults), these differences were not significant. Prior research suggests that younger adults find pursuit of resources more salient compared to older adults (Nurmi, 1992); therefore, we presumed younger adults would find frustration related to failing to achieve a goal to be more evocative when compared to older adults. One possibility for the lack of a predicted age difference in failure-based sadness could be the different ways that participants potentially appraised "failure" beyond what was expected by our rating scheme. For instance, it is possible that failure was linked with other reactivity labels (such as frustration). Follow-up analyses from the present study revealed that, in fact, both older and younger adults rated frustration adjectives to a comparable level as failure adjectives in this condition. Thus, participants may have been experiencing a more complex blend of negative affectivity within a failure context that muted potential age differences within just the failure adjective dimension.

It is also possible that older adults were demonstrating a higher reactivity profile to failure scenarios than we had expected. One way to assess this possibility was to look back on the types of failure memories participants generated and at what time in participants' lives they occurred. Follow-up analyses based on paired-samples *t*-tests revealed that, in fact, during the failure condition, older adults were recalling memories from much earlier ages compared to the other three conditions. In other words, older adults were selecting memories from their youth rather than their recent past (within the past year). If older adults were primarily engaging in failure memories that occurred during comparable age to the younger adults, it is possible that an uptick in failure-related reactivity was due to the older participants reflecting on the felt disappointment at the time of those events. Hence, it is possible that by recalling memories from a time when failure was more relevant, failure-related reactivity was enhanced.

Regarding frustration, we predicted younger adults would be more reactive compared to older adults, as past studies have found younger adults to be more reactive to interpersonal conflict that could facilitate frustration than their older counterparts (Blanchard-Fields & Coats, 2008). These interpersonal conflicts are primarily defined as situations in which there is a blocked goal of significance to the individual. Our results showed that younger adults rated frustration higher than older adults; however, this difference was not statistically significant. One possibility for the lack of an expected age difference in this condition could be due to how frustration was conceptualized by the present sample. An initial scan of themes that participants gravitated towards when remembering frustrating life events, based on responses to the type-out task, revealed that younger adults often mentioned themes based on societal and value-based frustrations

rather than the more proximal experiences of blocked goals and/or interpersonal conflicts. For older adults, we found recurrent themes of moral indignation, long-term consequences, and regret, themes that align closely with loss and violation—two emotion subtypes we expected to be more relevant at older ages. It is possible that if we had directly guided participants to focus on blocked goals and interpersonal conflicts, significant age differences in frustration reactivity may have emerged. This is based on prior research demonstrating age differences in anger reactions when reminiscing about blocked goals whereby younger adults are more reactive compared to older adults (Kunzmann, et al. 2017). On the other hand, older adults may have been more fixated on other blended affective states (such as loss and indignation), which may have resulted in unexpected increased frustration reactivity.

Related to the potential for "blended" affective states, for conditions where results did not conform to expected age differences, it is possible that a mixed emotions model could be informative. Past research has found that individuals may experience mixed within-valence blends of emotion states, that is, simultaneously experiencing two or more negative affective states (e.g., a combined state of fear and sadness; Watson & Staton, 2017). Additional research has found age differences in mixed, same-valence experiences, where older adults experience comparably high levels of disgust, anger, and contempt when evaluating a single affect elicitor (Charles, 2005). The present study could suggest that both older and younger adults may experience different constellations of mixed emotions, which could relate to the age similarities in reactivity when only examining one affect label for a given subtype condition. For example, our results revealed that younger adults reported experiencing feelings of failure during the violation

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condition. It may be the case that younger adults attend to elements of failure in violation situations, thus diminishing the degree of reactivity they attribute to violation, alone, and experience simultaneous feelings of failure. It is perhaps the case that individuals are not only more reactive to what they appraise as of primary relevance, but they may also keenly notice and extrapolate additional relevant themes from elicitors. In our study, younger adults may have attended to aspects of failure during the violation condition because failure is more relevant to younger adults; therefore, they may be naturally more perceptive toward additional failure-related features. Similarly, it was revealed that older adults reported experiencing some amount of loss during the frustration condition. It is possible that older adults may have fixated on loss-related aspects of their frustration-based memories, supplementing overall reactivity and amplifying feelings of frustration. Overall, these secondary findings may allude to a mixed emotions theory that adds a layer to age-related differences in emotion reactivity profiles.

Limitations

A few study limitations should be noted. Perhaps the most pressing limitation was the use of a single self-report metric to measure emotional reactivity. While we tested this measure beforehand, it is always possible that self-reports do not fully depict the scope of emotional reactivity. Ideally, we would have tried to include other reactivity measures (e.g., psychophysiological measures, such as electrodermal activity and heart rate variability, expressive behavior, etc.) to assess arousal, allowing us to obtain a more comprehensive assessment of reactivity. These additional markers open up potential for age differences that may not have been fully accounted for through self-report. Prior research has found significant age differences in self-reported emotional reactivity, but

when examining physiological and behavioral measures, results diverge (Seider, et al., 2011); therefore, assessing these additional measures could provide a more comprehensive understanding of our results. Additionally, our self-report measure was determined by a factor analysis of our pre-study results. This pre-study utilized 20 participants, a relatively limited sample size, which may have undermined the validity of the measure due to low statistical power. Future research may replicate this pre-study with an appropriate sample size to improve power and potential threats to validity.

The validity of the method of self-reported affect may be best supported by its conceptualization. The emotional adjectives selected to represent each condition were conceptually derived from linguistic analysis of synonymous words. For each condition we selected the most related emotion-based adjectives and excluded words that were not emotion based or relevant. The vocabulary representative of loss were the three most related emotional adjectives (loneliness, hopelessness, and despair) as well as the eighth most related (regret). Failure was represented by its top two related words (defeat and shame) and its fifth most related word (guilt). Frustration was represented by its two most related adjectives (irritation and annoyance) while violation was represented by its fourth, fifth, and eighth most related words (disapproval, offended, and outrage, respectively). Furthermore, as noted in the results, for each condition, the corresponding affect rating was the highest rated (i.e., loss was the highest rated affect during the loss condition) further supporting the validity and reliability of this measure.

Our method of elicitation may have also had some limitations. The benefit of allowing participants to select their own memories allowed us to account for potential individual variability in what is deemed evocative across our discrete emotional

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categories. Such individual variability can be challenging when participants are exposed to the same, standard stimulus (i.e., a video or image). However, having participants engage in this form of elicitation could have potential limits due to the nature of online data collection. We had a lack of experimental control over each participant's task environment that could have impacted the elicitation process (i.e., television on in the background, distraction from family members/housemates, etc.). With that said, it is unlikely that any limits to the method of elicitation and experimental conditions greatly impacted our results. Participants were demonstrating significant self-reported reactivity levels to their generated memories (i.e., no drastically low ratings for either age group for any condition), and participants were providing detailed descriptions during the "type-out" tasks.

Another potential limitation for this study is participant fatigue. On average, this study took 45 minutes to complete. This length, combined with the repetitive nature of the procedure, may have led some participants to become irritable or bored, thus impacting their affect ratings. This seemed to especially be the case for younger adults who rated higher on feelings of frustration following the neutral video tasks as the study progressed. However, this tendency did not significantly impact the present results given that the experimental conditions were randomized; thus, analysis of the order of conditions revealed no statistically significant differences in emotion reactivity ratings, specifically regarding excess feelings of frustration beyond what would be expected for a particular condition. Therefore, this study did not reveal any order effects that would have impacted self-reported affect ratings. Nevertheless, for future studies, we should be

considerate of study duration so as to better ensure that emotional reactions are more assuredly reflective of specific experimental conditions alone.

Future Directions

The results of this study suggest that future research should consider further dissecting potential subtypes of discrete emotions and how they may relate to different age groups. More specifically, future studies should examine what aspects of discrete emotions are more salient to older and younger adults. We initially theorized that subtypes of sadness may differ on a dimension of perceived situational autonomy (failure associated with greater perceived autonomy and loss associated with less perceived autonomy) while subtypes of anger may differ on a dimension of perceived situational proximity (violation associated with less proximity and frustration associated with greater proximity). Future research should consider exploring these and other dimensions more closely to better understand which aspects of discrete emotions are associated with greater emotional reactivity and if they are based on relevance and salience.

This study collected qualitative data through the type-out task in which participants typed their selected memories and explained the most important details and emotional aspects. This data can be used in future research to further dissect emotional subtypes and to start to construct the primary themes that may arise within each age group and subtype. The results from this study found that there were significant age differences in emotional reactivity to emotions that were not congruent with the specified condition (i.e., older adults reported an uptick in loss during the frustration condition). Future studies addressing this qualitative data could investigate recurrent themes that could reflect potential age differences that were not fully revealed by the quantitative

affect ratings. For instance, it is possible that different age-based themes could be present despite age-similarity in reactivity ratings for certain conditions.

Future research could also investigate the role of emotion regulation on discrete emotion subtypes and how regulation may explain some of the inconclusive results from this study. Prior research investigating age differences in emotion regulation strategies has found that older adults tend to use different strategies than younger adults depending on the discrete emotion experienced as well as corresponding intensity (Schirda et al., 2016). Regulation could also be dependent on individual goals above and beyond the discrete elicitor and its intensity (Schiebe & Carstensen, 2010). Future studies may be able to investigate differences in regulation strategies based on subtype contexts as opposed to only discrete emotions, which could emphasize the role of relevance and goals on regulation strategy selection and/or efficacy.

Related to emotion regulation of emotional subtypes is how individuals may deliberately choose to immerse in certain affective states (even unpleasant ones) in a pro-active, rather than a reactive, way (Tamir, 2008). This form of instrumental emotion regulation suggests that, in contrast to hedonic motivation (the motivation to pursue pleasure), individuals at times are concerned with experiencing an emotional state that is most useful for a given situation, regardless of valence. The discrete emotions approach similarly adheres to a functionalist perspective of emotions; that is, all emotions serve a pragmatic function despite valence or pleasantness. Thus, future research on discrete emotion subtypes could investigate age differences in the role of instrumental regulation on reactivity profiles. For example, it may be that younger adults find anger more useful during frustration events compared to older adults, as younger adults may be motivated

by goals that use anger instrumentally whereas older adults may not find it practical to immerse in frustration-based anger. Here, older adults may be more inclined to utilize passive or avoidant regulation strategies during a frustration condition, while younger adults may be prone to using proactive strategies, as prior research suggests older adults tend to use passive regulation strategies during interpersonal conflicts (Blanchard-Fields, Stein & Watson, 2004). By contrast, during a moral violation situation, we may see older adults employ proactive engagement strategies while younger adults may be more passive.

Beyond regulation, results from this study suggest that a mixed emotions model should be considered for future studies examining age differences in emotional reactivity, specifically for discrete emotion subtypes. Future studies should explore how older and younger adults rate blended or mixed emotions during various discrete emotion subtypes. Such assessments could further elucidate the motivations and goals at different ages that help inform the relevance of an elicitor. Taking into account how a combination of emotions is being experienced may allow for deeper examination into what motivates relevance appraisal in older and younger adults.

Conclusion

This study has provided further evidence that emotional reactivity is associated with the relevance of the emotional elicitor. We have further provided evidence for some age differences in reactivity based on subtypes within discrete emotions. Our results found that older adults had greater reactivity to a subtype of anger (violation-based) compared to younger adults, which is in contrast to prior research that has typically associated younger age with greater reactivity to anger. While further research is

necessary, this study has provided insight into aging and discrete emotion subtypes that can help develop and further current understanding regarding whether life span trajectories of emotional reactivity are stable or adaptive and what specific factors might predict emotional reactivity profiles between age groups. More specifically, this study potentially can add to the significance of relevance appraisal in emotional aging theories.

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