THE INFLUENCE OF REGULATORY FOCUS AND SELF-DISCREPANCY ON COGNITION IN YOUNGER AND OLDER ADULTS

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by

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A thesis presented to Ryerson University

in partial fulfillment of the requirements for the degree of Master of Arts in Psychology

Toronto, Ontario, Canada, 2013

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Abstract

There exists substantial literature describing how the two motivational systems of promotion and prevention (Regulatory Focus Theory; Higgins, 1997) influence behaviour. However, the specific cognitive correlates of regulatory focus remain unclear. Furthermore, how regulatory focus may influence the course of cognitive aging is unknown. Experiment 1 compared healthy older and younger adults on Higgins' measure of self-discrepancy and explored relationships with cognition. Experiment 2 compared younger adults induced into either a promotion or prevention focus relative to a no-induction control condition on measures of cognition. The results from Experiment 1 revealed that while the magnitude of self-discrepancy remains constant across the lifespan, the evaluation and content of self goals changes with age. The results from Experiment 2 suggest that the effects of the regulatory focus induction are limited but specific to particular aspects of memory and perception. Overall, these findings may contribute to our understanding of aging and motivated cognition.

Acknowledgements

First and foremost, I owe my supervisor Dr. Julia Spaniol the largest thank-you for guiding and supporting me through this process. Second, I extend this gratitude to the rest of my defense committee, Dr. Naomi Koerner and Dr. Stephen Want, for making this research stronger. Dr. Koerner's feedback at several points during the research process was instrumental. I would like to thank the M.A.D. lab members, Holly Bowen, Gaby Kostova, and Pete Wegier, for their support, as well as my keen and thoughtful lab volunteer, Nirvair Grewal, for helping me with the data collection. Finally, I would like to thank my parents and especially A.O. for helping me make it through Masters number three.

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RFT	Regulatory focus theory
SDT	Self-discrepancy theory
SOC	Selection, optimization, and compensation
EEG	Electroencephalography
fMRI	Function magnetic resonance imaging
BIS/BAS	Behavioural inhibition and behavioural approach/activation systems
PFC	Prefrontal cortex
RFQ	Regulatory focus questionnaire
SST	Self-strength task
RT	Reaction time
SEST	Socioemotional selectivity theory
DASS	Depression Anxiety and Stress Scale
PANAS	Positive and Negative Affect Schedule
DSC	Digit Symbol Coding
MMSE	Mini-Mental Status Examination
ANEW	Affective Norms for English Words
ANOVA	Analysis of variance

The Influence of Regulatory Focus and Self-Discrepancy on Cognition in Younger and Older Adults

Chapter 1: Introduction and Theoretical Background

The impetus behind this research is to investigate the interplay between motivation and cognition within the context of healthy aging. The broad aims are to investigate how self-goals (traditionally, a topic of social psychology) influence cognitive performance, and how this relationship between goals and cognition may change across the lifespan. Using Higgins' theory of regulatory focus (RFT; Higgins, 1997) and self-discrepancy theory (SDT; Higgins, 1987), as well as Markus and Nurius' (1986) conceptualization of possible selves as starting points, I explore how they may be extended to aging by drawing on lifespan theories of human development. Although RFT and SDT were not initially developed with consideration of older adults, some lifespan psychologists have subsequently extended these theories into the realm of aging. Indeed, there are many concepts highlighted in RFT and that are also central to predominant theories about human development, such as Baltes and Baltes' (1990) Selection, Optimization, and Compensation Model (SOC). A vast body of literature on cognitive aging exists, but how motivation may influence cognitive function across the lifespan continues to be explored, and I hope to contribute to this literature with the current research.

First, I will begin by reviewing the relevant literature, specifically concerning RFT and SDT, possible selves, the major lifespan theories, and cognitive aging. Next, I will describe the hypotheses, methods, and results of the 2 experiments that comprise the current research. Experiment 1 included a healthy sample of older and younger adults. I used Markus and Nurius' (1986) construct of possible selves and Higgins' SDT (1987) to understand how future conceptions of the self, which represent one facet of motivation, may change with age, and how this may relate to affect and cognition. Self-discrepancies and possible selves were elicited using

Higgins' self-strength task and the cognitive domains measured were visual perception and emotional memory, as these tend to be associated with age-related change. In addition to a quantitative analysis, a qualitative analysis of the self-discrepancy task was performed, which represents a novel contribution to the literature. This analysis provided insight into how the specific contents of future selves tapped by this instrument change with age. Experiment 2 continued to explore RFT in a sample of exclusively younger adults. To investigate the cognitive corollaries of RFT more directly, the participants underwent a regulatory focus induction task, after which they performed the same cognitive tasks as described in Experiment 1. After reporting the outcomes of these experiments, a general discussion is presented in order to synthesize and contextualize the findings, and speculate on future research directions.

1.1 Possible Selves, Self-Discrepancy Theory, and Regulatory Focus Theory

Markus and Nurius (1986) described future or possible selves as individuals' conceptions of who they might become, encompassing both who they aspire to be and who they are afraid of becoming. Individuals can hold a multitude of selves, which may remain consistent with time, or may develop, emerge, or fade in significance from moment to moment. Possible selves represent an individual's specific hopes, dreams, aspirations, and fears. They connect motivation to cognition in that, as specific cognitive schemas, they provide incentives for future behaviour as well as a basis for evaluation of the current self (Markus & Nurius, 1986). Possible selves shape goal-directed behaviour by representing both desired and undesired end-states. That is, there is a distinction, in terms of affect and self-regulation, between approaching desired selves and avoiding undesired selves (Higgins, Roney, Crowe, & Hymes, 1994). Depending on which future self is used as the point of reference, different self-regulatory states are assumed to be activated. Higgins (1987) expounds this idea in SDT, which extends Markus and Nurius' notion

of possible selves (1986). SDT proposes that individuals may hold various types of self-guides, or points of self-reference, against which they evaluate their current self. Furthermore, Higgins posited that discrepancies between future and actual selves correspond to negative affect. This notion is not new; indeed experts ranging from Freud (1923/1961) to Rogers (1961) have asserted that self-discrepancies are negatively related to well-being. Higgins' SDT adds to this by predicting how specific types of self-discrepancies are associated with specific types of negative affect, thereby improving the theory's explanatory power (Higgins, 1987).

Generally speaking, SDT asserts that two types of self-discrepancies exist, depending on which future self is taken as the reference point for the evaluation of the actual or current self. Higgins (1987) described two types of desired, future selves. Ideal selves represent hopes, wishes, and aspirations, whereas ought selves embody duties, obligations, and responsibilities. SDT predicts that different emotions will arise depending on which type of self-guide is used for comparison: ideal-actual discrepancies should lead to dejection-related emotions (such as depression) whereas ought-actual discrepancies should instead lead to agitation-related emotions, like anxiety (Higgins, 1987). Theoretically, individuals are motivated to reduce such disparities in order to quell emotional distress. Although empirical research conducted by Higgins has supported these affective/emotional predictions, efforts by other research teams have been equivocal (e.g. Tangney, Niedenthal, Covert, & Barlow, 1997). Higgins responded that in light of these mixed findings, SDT must be refined by uncovering *when* these specific affective associations arise (Higgins, 1999). He proposed several candidate moderators and mediators, such as the magnitude of the self-discrepancy, the accessibility of the self-discrepancy, the relevance of the self-discrepancy to the current context, and the relative importance of the self-

discrepancy to the individual (Higgins, 1999). Nevertheless, empirical research is ongoing with respect to the conditional nature of the discrepancy-emotion relationship.

RFT, also proposed by Higgins, builds on SDT and accounts for how possible selves relate not only to affect, but to motivation and behaviour more explicitly (Higgins, 1997). As such, the theory moves beyond descriptive accounts of self-knowledge and instead elucidates how self-knowledge directly relates to action. RFT is rooted in an evolutionary and developmental perspective. Higgins (1997) conceptualized self-knowledge (including possible selves) in terms of its relation to survival and therefore self-regulation. Survival needs involve both nurturance and security, and one's goals largely map on to one or the other. In order to achieve such goals or needs, individuals can apply one of 2 types of regulatory systems. Being oriented towards nurturance (including gains and achievement) involves a *promotion* regulatory state, whereas being concerned with security needs (such as protection) involves a *prevention* regulatory state. Promotion focus is concerned with the presence (or absence) of positive outcomes, and is motivated by aspirations and growth. In contrast, prevention focus is concerned with negative outcomes, and is driven by oughts, safety, and responsibilities (Crowe & Higgins, 1997). Thus, moving beyond the basic hedonic principle of motivation, whereby individuals are driven to avoid pain and achieve pleasure, RFT describes how individuals can be motivated to realize two types of desired end-states (accomplishment or security, respectively), through either a promotion or prevention focus (Higgins, 1997).

RFT is also more complex than basic conceptualizations of motivation (i.e., pleasure/pain) in that it makes clear predictions about the types of goals individuals choose to pursue, the kinds of strategies they will adopt, and the variety of affective states that achievement or failure to attain the particular end-state will produce. As such, RFT has implications for

cognitive psychology as it makes predictions about information processing, risk-taking behaviour, and emotional outcomes. Regarding goals, a promotion focus is related to ideal selves; one is driven to attain the hoped-for and aspired-to-be future self. A prevention focus is related to ought selves, whereby one is motivated to fulfill one's duties, obligations, and responsibilities (Higgins *et al.*, 1994; Higgins, 1997). Those with a promotion focus are *eager* to find means of advancement and success while those with a prevention focus are more *vigilant* in order to protect against failure (Higgins, 1997). Interestingly, the same goal can be desired by individuals in either regulatory focus. That is, a particular goal can be represented as an ideal by one individual and as an obligation by another. Nevertheless, the theory predicts that these goals would be pursued differently depending on the particular focus.

1.2 Regulatory Focus: Relation to Cognition, Emotion, and Behaviour

These strategies (i.e., eagerness or vigilance) have often been analyzed in terms of signal detection theory (Green & Swets, 1966), as well as in terms of a speed/accuracy trade-off that depends on the regulatory focus (Forster, Higgins, & Bianco, 2003). Promotion focus entails a preoccupation with wins while prevention focus is concerned with losses. Promotion focus is associated with a liberal response bias, reflected in a higher number of "hits" as well as "false alarms". Overall, promotion focus is associated with more risky behaviour and speed, but less accuracy. Conversely, prevention focus is reflected in a higher number of "misses" but also correct rejections. As such, prevention focus is associated with conservative tendencies and slower, more accurate responses[1]. These hypotheses have garnered support from several empirical studies (e.g., Crowe & Higgins, 1997; Forster, et al., 2003). For example, in the study

[1] Unless the individual is facing a loss outcome. This is associated with a different pattern of behaviour; see Scholer & Higgins, 2008, and Scholer, Zou, Fujita, Stroessner, & Higgins, 2010 for a deeper discussion of the situational contingencies.

by Crowe and Higgins (1997), participants were induced into either a promotion or prevention focus by viewing instructions that framed the task differently. In the promotion condition, participants were told that if they performed well on the upcoming memory task, they would get to perform the task that they liked at the end, while in the prevention condition, they were told that so long as they did not do poorly, they would not have to perform their disliked task. Next, participants viewed a series of letter strings. Participants then completed a recognition memory task where they viewed old and new letter strings and had to decide if they had seen the string before. Participants in the promotion condition tended to respond 'yes' more often, consistent with a risky response bias, whereas those in the prevention condition demonstrated a conservative inclination to say 'no'.

Several other characteristics have been related to either promotion or prevention states. For instance, promotion focus is associated with greater creativity and enhanced global processing (i.e., better perception of the whole rather than its parts), while prevention focus is related to less creativity, but superior analytical skills and greater local processing (Forster & Higgins, 2005; e.g., Friedman & Forster 2001). These associations have been found both when regulatory focus is measured as a trait and as a state. Regulatory focus may also affect autobiographical memory. In one study, promotion- and prevention- induced (by having them think about their hopes and wishes or duties and obligations) individuals recalled different kinds of interpersonal episodes (e.g. supporting a friend versus losing touch with a friend; Higgins *et al.*, 1994). Importantly, neither eagerness- nor vigilance-related strategies are universally superior; rather both can be adaptive (or maladaptive) depending on the task or situation. For instance, two individuals with a promotion and prevention focus, respectively, may both attain similar levels of academic success (Higgins, *et al.*, 2001). However, on the one hand, the

promotion focused individual may construe their success as an achievement, and employ strategies such as studying extra material or participating in study groups. On the other hand, the prevention focused individual may view academic achievement as an obligation, and employ strategies such as ensuring that they know the assigned material thoroughly (Higgins *et al.*, 2001).

As mentioned earlier, RFT also predicts the emotions that occur upon succeeding or failing to achieve goals (Higgins, 1997). When those with a promotion focus achieve their goals (i.e., gains), they experience joy and happiness, or cheerfulness-related emotions. When they fail, they experience dejection (sadness or depression), as their failures are not conceptualized as losses but rather nongains. In contrast, achieving the desired end-state in a prevention focus is viewed as a nonloss, and thus the resultant emotions are quiescent states, like relief and calmness. Failure or a loss brings about feelings of agitation, such as anxiety or nervousness. RFT also makes predictions for psychopathology. As such, RFT dovetails with SDT: Large discrepancies between current and ideal selves/goals are related to depression (i.e., dejection-related emotions) whereas differences between current and ought selves/goals are more likely to result in anxiety and fearfulness (Strausman & Higgins, 1987). Of note, positive mood state has not been found to mediate the relationship between regulatory focus and cognitive functioning (Higgins, Idson, Freitas, Spiegel, & Molden, 2003).

The neuroscience literature has begun to explore the neural correlates of regulatory focus. In an electroencephalographic (EEG) study, Amodio, Shah, Sigelman, Brazy, and Harmon-Jones, (2004) found cortical asymmetry with respect to regulatory focus. Chronic regulatory focus was measured in an initial session using a reaction time task where participants were ask to list their ideal and ought attributes (lower latencies reflected larger strength of the particular

regulatory focus), and this was associated with resting state EEG activity in a second session. More specifically, predominant promotion focus was related to greater left frontal cortical activity while prevention focus was associated with right frontal cortical activity (Amodio, *et al.*, 2004). Additional studies suggest that different regulatory states are associated with differential information processing (Cunningham, Raye, & Johnson, 2005; Eddington, Dolcos, Cabeza, Krishnan, & Strauman, 2007). Using fMRI, Cunningham and colleagues (2005) found that the evaluation of positive stimuli was specifically associated with greater activity in the amygdala, anterior cingulate, and extrastriate cortex for those in a promotion focus. Meanwhile, the same pattern of activity was seen during the evaluation of negative stimuli for individuals in a prevention focus. The interpretation was that these opposing regulatory states are not supported by separate neural systems. Instead, perhaps additional, attentional processes are recruited.

Johnson and colleagues (2006) studied differences in brain activity using fMRI between thinking about goals and aspirations or duties and obligations compared with a non self-relevant control condition. Both experimental conditions were associated with activity in areas of the medial cortex, which are known to underpin self-relevant processing (e.g., Oschner et al., 2005). Furthermore, there was a double dissociation. The medial frontal cortex showed relatively more activation in the promotion condition, whereas the medial posterior cortex, mainly the posterior cingulate, was associated with greater activation in the prevention versus the promotion condition. Thus, both regulatory foci may be distinguished on a neurological level.

In another fMRI study, the purpose was to investigate the neural correlates of promotion and prevention goal priming, and to test whether these correlates could subsequently be detected when performing a task indirectly related to the goal content (Eddington *et al.*, 2007). In the scanner, participants were incidentally primed with idiographic promotion or prevention goals

(generated beforehand) that were embedded in a depth-of-processing task. In this task, participants were required to make semantic and nonsemantic judgements of trait adjectives (Eddington *et al.*, 2007). Promotion goal priming was specifically associated with left orbital prefrontal cortex (PFC) activation and the magnitude of activation was positively related to the Regulatory Focus Questionnaire (RFQ[2]) promotion subscale scores. However, unique activation of right PFC areas was not seen with respect to prevention goal priming. In trying to explain the surprising finding, the authors speculated that the sample, consisting of typical undergraduates, was predisposed towards approach-related orientations. This speculation was supported by significantly higher promotion (than prevention) scores on the RFQ.

If emotional stimuli are differentially processed depending on the regulatory focus (i.e., in a focus-consistent manner), then it follows that such stimuli may be remembered differently. Touryan and colleagues (2007) conducted a neuroimaging study of emotional memory to test this hypothesis. Overall, memory was greater for those induced into a prevention focus. Greater activation was observed in the posterior cingulate during processing of focus-consistent stimuli (i.e. negative for prevention and positive for promotion) during encoding. Likewise, parahippocampal activity was also predictive of memory success but only for focus-consistent stimuli (Touryan *et al.*, 2007).

1.3 Possible Mechanisms Underlying Regulatory Focus

The mechanisms underlying the effects of regulatory focus on cognition and behaviour are unclear. It is possible that such manipulations directly affect cognitive processes. For instance, a type of semantic priming could occur, whereby certain knowledge structures become

[2] Examples of questionnaire items include: "Growing up, would you ever 'cross the line' by doing things that your parents would not tolerate?" or "Compared to most people, are you typically unable to get what you want out of life?"

more accessible. However, it is also possible that the effects could be mediated by other factors, for example mood or affect. Although mood has not been found to mediate the effects of regulatory focus on cognition (e.g., Higgins et al., 2003), it is possible that priming a prevention focus by thinking about oughts could elicit negative affect in an individual who perceives a large discrepancy between their actual and ought selves. For instance, such primes could bring to mind past and current failures to fulfill obligations or responsibilities. Indeed, SDT predicts anxiety and guilt to result from this type of discrepancy (as described earlier). This anxiety (or other types of affect) could in turn mediate the influences on experimental tasks.

Another possibility is that a mismatch between the induced and chronic regulatory focus could lead to cognitive discrepancies, explained by the regulatory fit hypothesis (Higgins, 2000; Keller & Bless, 2006). According to regulatory fit, performance is optimal when there is consistency between an individual's chronic regulatory focus and the task's instructions, framing, incentives, and strategy requirements. Keller and Bless (2006) found that performance was best when there was agreement between chronic and induced regulatory focus, compared with when there was a mismatch. They speculated that such mismatches could be more cognitively demanding, as one must allocate more resources to managing the discrepancies (Keller & Bless, 2006). As a consequence, there would be fewer cognitive resources available to devote to the task at hand.

Finally, stereotype threat (Steele, 1997) is another mechanism by which regulatory focus may exert its effects. Thinking about oughts could prime negative stereotypes for vulnerable individuals (Hess, 2006). Individuals experiencing stereotype threat aim to avoid failure: confirming the stereotype would be a loss and disconfirmation would be a nonloss; this is consistent with a prevention focus (Seibt & Forster, 2004). As an example, it has been suggested

that older adults may incidentally experience stereotype threat during certain types of cognitive tasks (e.g., a memory task; Hess, 2006). Such tasks may activate negative stereotypes about aging (e.g. older adults have poor memories), which may consequently impair performance (Hess, 2006). Hypothetically, thinking about ideals or oughts could activate negative self-stereotypes (for example, about a particular feared self), or other salient factors such as negative outcomes or external expectations. Indeed, one study found that activating positive or negative self-stereotypes was associated with behaviour that was congruent with a promotion or prevention focus, respectively (Seibt & Forster, 2004). However, it is also possible that thinking about ideals or oughts could activate positive self-stereotypes. Nevertheless, it has yet to be determined if activating particular regulatory foci elicits stereotype threat.

A difficulty in clarifying the matter is that stereotype threat is believed to be multifactorial in nature (Steele, Spencer, & Aronson, 2002). For instance, anxiety is purported to be a central mechanism for the effects of stereotype threat (Spencer, Steele, & Quinn, 1999). However, in empirical studies of stereotype threat, anxiety has not been reliably found to be the mediator (e.g. Hess et al., 2003). In response, it has been suggested that self-report measures do not always capture anxiety and that implicit measures may be more appropriate (e.g. Bosson, Haymovitz, & Pinel, 2004).

Elucidating the mechanisms underpinning regulatory focus speaks to the broader relationship between cognition, motivation, and behaviour. Both regulatory focus and stereotype threat have been shown to influence higher-level cognitive processes such as episodic memory (e.g. Touryan et al., 2007; Mazerolle, Regner, Morisset, Rigalleau, & Huguet, 2012). At the same time, there is evidence that stereotype threat affects lower-level cognition such as basic motor processes. For example, older adults showed up-regulated physiological responses to

stress (Levy et al., 2000), and younger adults had reduced walking speed (Bargh, Chen, & Burrows, 1996) when exposed to negative aging stereotypes. Such basic, motor processes have yet to be studied with respect to regulatory focus. Is regulatory focus similar to stereotype threat and other examples of priming, in that both higher- and lower-order processes are affected? Regulatory focus has been shown to influence cognitive processes obviously related to goal pursuit and in tasks with clear motivational content (like emotional memory; Touryan et al., 2007) but it is unknown whether influences are also reflected in more basic processes that are less directly related to motivation. A fuller understanding of the relationship between regulatory focus and both higher- and lower-level processes will complement our knowledge about the nature of motivated cognition.

1.4 Regulatory Focus: States, Traits, and Change across the Lifespan

The regulatory states of promotion and prevention have been described as both traits and states. When considered as traits, they are presumed to be shaped through development by relationships with primary caregivers (Higgins, 1996). With time, individuals tend to adhere more and more to a particular regulatory focus, which ostensibly becomes chronic and stable. Self-report measures have been developed to index one's predominant orientation (Higgins & Spiegel, 2004; Summerville & Roese, 2008). The Regulatory Focus Questionnaire (RFQ), arguably the most widely used measure of this nature, is predicated on the assumption that one's chronic regulatory focus is highly and reliably accessible and easily activated. The RFQ measures one's subjective history of promotion- and prevention- related self-regulation (Higgins et al., 2001). The theory predicts that individuals will maintain a relatively stable regulatory focus even if the content (of the possible selves, for instance) changes. Considering the current research however, this measure has only been used with college/university aged individuals and

may not be appropriate for older adults. Some items on the task address academic goals and parental expectations, both of which may be irrelevant or at least different in temporal quality for younger versus older adults.

Another idiographic measure that has been used to assess chronic regulatory focus is Higgins' self-strength task (SST), which integrates RFT and SDT (Higgins, Shah, & Friedman, 1997). It was designed to quantify the discrepancy between actual (i.e., current) and future (ideal and ought) selves. Participants are required to generate one-word attributes that describe the type of future self they hope or feel they should attain. Subsequently, they must rate how much they aspire/ought to possess this attribute (i.e., future self-rating) and then how much they currently possess the attribute (i.e., actual self-rating). It is assumed that the predominant self-type is more accessible and as such, it is possible to determine which type of self (ideal or ought) is more chronic based on reaction time (RT) latencies corresponding to when participants enter their attribute and indicate their ratings. That is, relatively shorter latencies are indicative of which type of future self is the predominant self-guide, which translates into the particular trait-like regulatory focus for that participant (Higgins, et al., 1997). Furthermore, this instrument allows for the quantification of the separate ideal and ought self discrepancies by averaging the differences between the corresponding future and actual selves. This measure has been used in a number of studies with younger adults but to my knowledge, not with older adults.

Regulatory states have also been viewed as situationally determined, varying depending on the environment, which includes variables such as task instructions, framing, or requirements. That is, regulatory focus has been described as dynamic in nature, similar to the above-mentioned concept of possible selves (Markus & Wurf, 1987). Experimentally, studies have also employed priming procedures (e.g., having participants think about particular goals or future

selves) in order to temporarily induce either a promotion or prevention focus and investigate the corresponding effects on various outcome measures. Generally, the findings associated with either a promotion or prevention focus are consistent between studies where regulatory focus is manipulated and studies where it is measured as a trait (e.g., Forster et al., 2003; Higgins & Spiegel, 2004).

In terms of stability across the lifespan, Higgins did not describe how RFT would apply within the context of aging, but some researchers have begun to explore its implications. Experts of lifespan psychology have studied differences in goal content generated by older and younger adults. This work draws upon Baltes' metatheory of development, known as the Selective Optimization and Compensation (SOC) model, which is one of the most recognized accounts of lifespan development (Baltes & Baltes, 1990; Baltes, 1997). The SOC model takes as its fundamental premise that development involves a balance of gains and losses, with the latter increasing in relative importance with aging. The theory seeks to understand how individuals cope with this changing balance and how they adapt to maintain function. The theory posits that this adaptation involves the interplay of three subprocesses: selection, optimization, and compensation. Selection refers to the targets or goals that an individual chooses and will be constrained by the available time and resources, which will vary as a consequence of life circumstances (including aging). Optimization represents the modulation of the means employed to reach the selected goals. Finally, compensation becomes relevant when the usual means of goal achievement are no longer available or effective and must be substituted with other means. In other words, compensation exemplifies the response to loss in means or resources with the aim of maintaining current functioning. Advocates of the SOC framework underscore its general

and meta-nature, and claim that its value lies as an overarching theoretical scaffold for other, more specific theories of lifespan development.

Given that the changing ratio of gains and losses is a fundamental tenet of the SOC model, lifespan theorists have related it to RFT, as this theory is also predicated on the relevance of gains and losses (e.g., Freund & Ebner, 2005). In terms of RFT, the rationale is that because losses increase in frequency and available resources diminish with aging, individuals should consequently experience a shift from a promotion focus to a prevention focus. In younger adulthood, the psychosocial environment fosters an emphasis on skill and knowledge acquisition, which is facilitated by optimal levels of biological plasticity (Ebner, Freund, & Baltes, 2006). With age however, the potential for biological and cognitive plasticity declines, and thus the emphasis shifts to the maintenance of what one has acquired alongside the prevention of future decline (Baltes, 1997). These experts also assert that it is adaptive for younger adults to be focused on gain maximization, whereas it is adaptive for older adults to shift to a prevention focus (Ebner, Freund, & Baltes, 2006).

Studies from neuroscience support these claims. Mitchell et al. (2009) extended the previously mentioned fMRI study by Johnson et al. (2006) to groups of both older and younger adults to capture neural differences in promotion or prevention focus. Whereas the double dissociation between anterior and posterior medial areas and promotion and prevention conditions, respectively, was replicated in the younger adults, this pattern did not emerge in the older adults. While the older adults also had greater activity in medial areas during the self-relevant conditions compared with the control condition, the difference in activity was attenuated. Furthermore, no dissociation in activity was found between the promotion and prevention conditions. Compared with younger adults, older adults showed the same amounts of

activation during the prevention condition in the posterior medial cortex. However, older adults had significantly less activation during the promotion condition in the medial frontal areas. These findings support the prediction that the promotion focus becomes less significant with advanced age.

A series of studies have also begun to explore the theoretical predictions through the study of personal goals. In terms of RFT and SOC, it is predicted that older adults should possess goals more characteristic of loss prevention (and/or the maintenance of resources, which is another motivational orientation that has been introduced in these studies) compared with goals typical of a gain or promotion orientation. Two further predictions have also been made: goal restriction and goal focusing. Older adults should exhibit goal restriction by selecting fewer goals compared with younger adults. Goal focusing refers to the expectation that the goals of older adults should encompass fewer life domains than those of younger adults (e.g., Riediger & Ebner, 2006; Penningworth & Scott, 2012).

The outcomes from these empirical studies have been mixed however. Using the construct of personal projects (Little, 1983), Ogilvie, Rose, and Heppen (2001) conducted a cross-sectional study with younger, middle-aged, and older adults and coded their personal projects for differences in motivational orientation. The motivational categories included: acquisition, keep/maintenance, to cure (an existing negative condition), and prevention. The acquisition motive was found in all age groups although it became less prevalent with age (70% of younger and 50% of older adults' projects, respectively). The keep/maintenance motive was greatest in the older group (25% of their projects, and hardly apparent in the projects of younger adults), while the cure motive was seen most in the middle-aged group. Interestingly, the prevention motive was not associated with any particular age group. Ebner and colleagues

(2006) studied goal orientation across the lifespan by asking younger and older adults to each list six of their most important personal goals: two from any life domain ("Please write down what you wish for personally, what you would like, and what you would not like at present and in the following weeks, months, and years"), two relating to cognitive functioning, and two relating to physical functioning. Participants also had to rate each of their goals for growth, maintenance, and prevention of loss using an eight point scale. Results indicated that the goals of younger adults were primarily growth-related while those of older adults were more reflective of maintenance and loss prevention compared with younger adults. Within the older adults however, growth and maintenance/loss prevention orientations were roughly equally represented. In other words, the relative importance of prevention goals increases with age but at the same time, growth-related goals remain prominent. Finally, well-being in younger adults was inversely related to having an orientation towards the prevention of losses, while in older adults, well-being was instead related to having a maintenance orientation. There were no associations between a gain focus and well-being in any age group. The authors' interpretation was that this reallocation of attention from growth to maintenance/loss prevention with age is adaptive (Ebner, Freund, & Baltes, 2006). In a similar procedure, Riedger and Ebner (2006) asked participants to list any number of personal goals, and then to rate which three were most important. Analyses showed evidence for goals restriction (i.e., fewer goals overall) and focusing (i.e., goals from fewer domains and/or from domains that were more similar and thus facilitative of achievement between them) in the older (age 60-69) compared with younger (age 20-59) adults. Relating back to the SOC model, it was speculated that having fewer and more interrelated goals represents an adaptive use of selection in order to maintain effective goal pursuit in the face of declining resources.

Finally, in a more recent cross-sectional study, Penningroth and Scott (2012) specifically tested the motivational predictions from the SOC model, including the predictions about goal restriction and focusing. They asked participants to list up to four current goals ("goals, hopes, plans, or dreams") and coded the content for life domain. Results showed that older adults had more goals characteristics of maintenance/loss compared with younger adults. Contrary to the secondary predictions however (and to the findings from Riediger & Ebner, 2006), the older adults did not generate fewer goals, and their goals did not cover any fewer life domains. The authors attribute the conflicting results to their use of slightly different methodology, as well as to the fact that the older adults in this study had higher levels of education than the older adults in the Riediger and Ebner study (2006), which could conceivably influence motivational pursuits.

Another way in which shifts in motivational orientation have been studied across the lifespan is through paradigms involving possible selves and self-discrepancies. Given that self-discrepancies are associated with negative affect, and that older adults tend to maintain well-being despite declines in function and increased experience of loss (e.g., Scheibe & Carstensen, 2010), experts have predicted that the magnitude of self-discrepancies should decrease with age (e.g., Ryff, 1991; Heidrich, 1999). Several empirical studies have taken up this prediction with mixed results.

Using an open-ended interview to elicit possible selves, preliminary studies (Cross & Markus, 1991; Markus & Herzog, 1992) discovered that older adults express fewer possible selves across fewer life domains than do younger adults, providing evidence of goal restricting and focusing (or selection, in terms of the SOC theory). This interview asks individuals to describe their hoped-for selves (i.e. their ideal selves in RFT terms) and actual selves, but not

their ought selves. Later studies have also added questions to elicit participants' feared (future) selves (which are not mentioned in RFT). Smith and Freund (2002) assessed a cohort of older adults (age 70-100+) from the Berlin Aging Study twice, four years apart. They found that some future selves generated at time 1 were cast off at time 2, while new selves were added (72% added new ideal selves and 53% added new feared selves). Even the oldest participants expressed desires to actively achieve possible selves. Moreover, these ideal selves were not merely desires to avoid negative outcomes or maintain current conditions. For the most part, interindividual differences were more important than age-related differences. All selves were then classified into one of six life domains. The most numerous domains were *personal characteristics* and *health* (as opposed to *social relationships*, which they had hypothesized would predominate). Lastly, the selves were coded for motivational orientation (maintenance versus loss prevention). It was found that developing a maintenance orientation was associated with less decline in life satisfaction over time.

In a related study focused on the content of possible selves, Frazier and colleagues (2002) compared three cohorts of older adults: those in their 60s, 70s, and 80s+. After coding the possible selves for life domain, it was found that *health* was the most salient for the oldest group. The *leisure* domain prevailed in the selves produced by the other two cohorts. Further studies of this nature have been conducted in samples of older adults with Alzheimer's disease, Parkinson's disease, and healthy controls (Frazier, Cotrell, & Hooker, 2003), as well as in cross-cultural samples (Waid & Frazier, 2003; Unemori, Omoregie, & Markus, 2004), depicting both stable and dynamic patterns of interindividual and group differences in the content and number of possible selves.

Finally, in an attempt to bridge possible selves with concrete self-regulation, a more recent study investigated how possible selves may relate to actual behaviour (Hoppmann, Gerstorf, Smith, & Klumb, 2007). Possible selves were again measured with the face-to-face interview, and daily activities were measured at five random time points per day over six days. Having hoped-for selves in the domains of *health* and *social relations* was associated with a greater chance of performing daily activities characteristic of those same domains. There was no relationship found between specific daily activities and selves in the *cognitive* domain, or with feared-selves in general. Furthermore, performing behaviours in the hoped-for domains was related to increased positive affect and chance of survival.

Other studies have employed slightly different methodology to capture possible selves and self-discrepancies. Heidrich and colleagues devised a 20-item self-report questionnaire with items asking about how much ideal and actual selves match across various life domains (e.g., Heidrich at al., 1994). Some studies have indeed found a decrease in discrepancies, usually driven by a decrease in ratings of the hoped-for selves (e.g., Ryff, 1991; Heidrich 1997). This has been interpreted as an instance of compensation (within the SOC framework) whereby the one's goals are adjusted for age-related declines in the actual self, which serves to maintain affective balance. Heidrich and Ward (1992) studied a sample of older women with cancer and found that while they made lower ratings for their actual and ideal selves than women without cancer, the magnitude of the self-discrepancies did not differ. It was presumed that the women were compensating for their decreased actual self-assessment by lowering their expectations for their ideal selves so as to maintain psychological well-being. Subsequent studies showed that self-discrepancy mediated the effects of health problems on measures of psychopathology and well-being (Heidrich, 1997). In a 6-year longitudinal study of older women with chronic illness,

Heidrich and Powwattana (2004) found that in spite of decreased physical health over time, self-discrepancies improved (i.e., became smaller). Self-discrepancy was a significant mediator of the effects of poor health on all other measures of mental health and well-being (i.e., depression, anxiety, life satisfaction, and affect balance), which supports the affective/emotional predictions of SDT. Further, they found that the effect of self-discrepancy for one of the well-being measures depended on level of physical health status. For women in good health, the magnitude of self-discrepancy was not related to happiness, while for those in poor health, having smaller self-discrepancies was associated with happiness levels characteristic of the women in good health. Findings such as these provide clues about the nature of resiliency in old age. It appears that with the increased salience of limited time combined with increasing amount of loss, individuals adjust the content and expectations of their future selves in order to maintain functioning and well-being.

Still, unanswered questions about the nature of possible selves and the relationship between self-discrepancy and behaviour remain. Although Heidrich's measure as well as the possible selves interview are similar to Higgins' SST, there are important differences. First, the SST elicits ought selves in addition to ideal (hoped-for) selves, which allows for a direct test of SDT. Further, the SST constrains responses to one word attributes, instead of open ended responses, and requires participants to generate a fixed number of selves whereas in the possible selves interview, the number of selves can be variable. It is of interest to apply the SST to older adults to provide a direct empirical extension of SDT and RFT to this population, namely with respect to the affective and cognitive/behavioural predictions. Finally, it is unclear if the various measures (i.e., possible selves, self-discrepancy, and SST) map onto each other; this is an empirical question.

1.5 Motivation and Cognitive Aging

Regulatory focus, SDT, and other theories of motivation significantly add to "cold" accounts of cognition by explaining how cognitive strategies are influenced by an underlying motivational system of either promotion or prevention. The regulatory focus framework may also significantly enhance our understanding of cognitive aging, which typically emphasizes brain-based explanations, by broadening the scope to include the role goals and motivation.

A large proportion of cognitive aging research seeks to uncover the physiological and neurological changes that occur with aging and underpin the corresponding cognitive profile (e.g. Luo & Craik, 2008; Salthouse, 2009; Zacks, Hasher & Li, 2000). Furthermore, much of this research typically promotes the view that aging is associated with inevitable cognitive decline. Indeed, a large body of literature reveals monotonic declines in average levels of cognitive performance, beginning in early adulthood (Salthouse, 2009). With respect to memory, which is of particular relevance to the current study, age differences are greater for some types of memory than others. For instance, perceptual, procedural and semantic memory remain relatively intact while working memory and episodic memory typically decline (Luo & Craik, 2008). Free recall shows the greatest impairment with age, presumably because it makes the highest demands on executive functions such as search, monitoring and response selection (Luo & Craik, 2008).

The mechanisms underlying cognitive decline in aging are still contested. Many accounts offer brain-based explanations (e.g. changes in metabolism, blood supply, dopamine tone, neural connectivity) of why many cognitive processes lose integrity with age (Luo & Craik 2008). Interestingly however, there is evidence for preserved plasticity in the neural correlates that underpin these cognitive domains, even in advanced age (e.g., Greenwood, 2007). In fact,

cognitive performance in these domains can be bolstered or compensated for given the appropriate environmental supports or task constraints (e.g., Troyer *et al.*, 2006). Moreover, there is a large amount of individual variation in age-related cognitive change (Lupien & Wu, 2004). While some individuals indeed experience significant cognitive decline, others show little deterioration, if any. The biological, psychological (including motivational), and social reasons for this variability are of great interest.

Some have criticized standard laboratory studies of cognitive aging for assuming that task-relevant goals do not change with age, "that personal goals will not systematically influence performance on the task at hand, and that task characteristics (e.g. instructions, materials) will activate the same goals in individuals across adulthood" (Hess, 2005, p.387). Indeed, many researchers are also recognizing how social and motivational factors significantly affect cognition, and when these variables are included into the discussion, several cognitive domains show preservation and even enhancement with aging (Blanchard-Fields, Horhota, & Mienaltowski, 2008). Younger and older adults may approach memory tasks differently as a function of distinctive goal orientations that have shifted with age (Hess, 2005). More broadly, this and related issues contribute to the larger discussion and research focus on motivated cognition with respect to aging.

For instance, a well-known finding (despite some debate about its causes and reliability) is that older adults show a positivity effect, where positive information is processed preferentially in older compared with younger adults (Carstensen & Mikels, 2005). This is in contrast to the negativity effect commonly found in younger adults, where negative stimuli are more engaging (e.g., Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). This finding is explained through socioemotional selectivity theory (SEST), which is consistent with the idea

that age-related changes in goal orientation influence cognitive function (Carstensen, Isaacowitz, & Charles, 1999). SEST describes how the shifts in emotional and motivational goals that occur with age significantly affect information processing and cognition. Perception of time changes with age: one's future time frame becomes more finite. Correspondingly, an individual's goals change in importance such that emotion regulation goals increase in significance. Meanwhile, knowledge-related goals, including acquisitive behaviour towards skills and knowledge, are hypothesized to decrease (Carstensen *et al.*, 1999). Older adults tend to be more present-focused, as opposed to concerned with the past or future. This is in contrast to other age groups, and as emotional goals grow in salience, attentional and cognitive resources are thought to be preserved and even honed for this purpose (Cartensen *et al.*, 1999). Despite the fact that losses tend to increase with age, older adults do not generally experience more negative emotions than younger adults. It is presumed that older adults are adaptive and accommodative and that this is reflected in their shifting goals and changing cognitive profile (Carstensen *et al.*, 1999). The positivity effect is presumably the outcome of a particular type of motivated cognition that prioritizes emotion regulation (Scheibe & Carstensen, 2010). SEST is a more specific account of motivational changes that occur with age, and can be situated within the metatheory described earlier, SOC. SEST takes up the reprioritization of social and interpersonal goals through selection (restriction and focusing) of goals, with the ultimate purpose of maintaining (emotional) functioning. Regulatory focus theory may likewise have something to add to the discussion about how the age-related evolution of personal goals, possible selves, and motivational strategies may affect cognitive processes such as memory and processing speed. The research carried out for this thesis was driven by this broad objective and will be described in detail in the following section.

Chapter 2: The Current Research

There are two overarching aims of the current research: to explore RFT and SDT as sources of individual differences in cognitive aging, and to investigate the cognitive processes implicated in the strategies associated with specific regulatory foci, both as traits and as induced states.

The first aim is to add to the literature on healthy cognitive aging. As there is much variation in cognitive ability with aging, it is of interest to explore whether regulatory focus or self-discrepancies represent meaningful sources of individual difference. Indeed, most research into how approach/avoidance motivation affects cognition has been conducted with younger adults. This is particularly concerning given that the majority of younger adults in psychological studies are college students who are typically concerned with promotion-related goals of skill, knowledge, and experience acquisition (Freund, 2006). Furthermore, this type of participant is usually situated within a context that reinforces promotion-related goals and strategies, which may not generalize to younger adults in different environments, and even less to older adults. Obviously, the physical changes that occur with aging explain some of the cognitive changes, but as alluded to above, motivational and social factors are also relevant (Blanchard-Fields *et al.*, 2008). Most studies on cognitive aging do not take into consideration the changing nature of goals across the lifespan and how these changes may affect memory performance (Hess, 2005). Possible selves (including ideal and ought selves) are important motivational structures that may represent one of the ways through which older adults adapt to aging (Herzog & Markus, 1999). Thus, this research will not only assess chronic regulatory focus, but will also measure the content and magnitude of the two types of self-discrepancies. Any relationships between these variables and affect and cognitive performance will be explored. Given that regulatory focus and

self-discrepancies may shift with age (Ebner *et al.*, 2006) a clearer picture of how they relate to cognitive function is of interest.

In the first experiment, baseline cognitive and affective measures were administered, followed by two cognitive tasks in order to establish if the samples of older and younger adults showed typical performance based on the literature. Finally, participants completed the measures of self-discrepancy and regulatory focus, which were the primary foci of this experiment.

The second experiment provided the opportunity to explore the second aim, the cognitive implications of regulatory focus. Previous research has established some of the behavioural correlates of particular regulatory states, but it remains unclear as to where in the course of cognitive processing the effects begin or are most important. That is, how far-reaching the effects of regulatory focus may be remains to be explored. There is evidence that priming can have effects on tasks that are not directly related to the prime (for example, like the walking speed studies; Bargh et al., 1996). Most theories of motivation assert that the particular motivational stance will guide behaviour, but often the specific behavioural correlates are unmapped. Employing a sample of younger adults only, a third had their chronic regulatory focus measured with the SST and served as the control group. Incidentally, these were the same younger participants from Experiment 1. Since they performed the same cognitive tasks as the participants in Experiment 2, it was possible to compare their performance with the other groups of younger adults in Experiment 2. The remaining participants underwent a regulatory focus induction (either promotion or prevention focused). This design allowed for an examination of whether or not chronic and situationally induced regulatory foci are associated with particular

affective and cognitive profiles as assessed by the same cognitive tasks employed in Experiment 1.

The two cognitive domains chosen as the outcome measures are perception and memory. More specifically, the first task measured low-level visual perception. This task is only indirectly related to regulatory focus, as well as typically motivational aspects such as valence or self-referential content. In contrast, the second task assessed a more high-level cognitive domain, emotional memory. These tasks were chosen because they represent central cognitive domains and because they are sensitive to typical age-related change. Further, they cover both low- and high-level cognition, providing some breadth for our exploration of the effects of regulatory focus. The perception task was analyzed with diffusion modeling, a technique that allows for a finer-grained analysis of the different components of information processing (Ratcliff, 1978; Wagenmakers, van der Maas, & Grasman, 2007). More specifically, this type of modelling allows the reaction time and accuracy results to be broken down into meaningful components: cautiousness/riskiness in responding, ability to acquire information from stimuli, and motor response. In a typical task, two measures can be derived: average response time for correct decisions, and proportion of correct responses.

Consider two hypothetical participants. The first has shorter reaction times (RTs) but fewer correct responses. The second has longer RTs but more correct responses. There are several possibilities for this pattern: the participants could have the same ability but the first is more willing to take risks. Alternatively, one of the participants could have a higher ability than the other. Given only these two measures, it is impossible to determine which scenario is the case (Wagenmakers *et al.*, 2007). It is unclear as to which measure should be given more weight in determining a participant's ability or the difficulty of a particular task. Diffusion modeling

allows for the measurement of other, unobserved cognitive parameters (described in more detail below) that can inform these questions. As an example of its application, Ratcliff and colleagues (2006) applied the model to recognition memory performance in older adults. Typically, recognition memory declines with aging, however this analysis revealed that older adults are slower because of longer non-decision time (that is, a slower motor response), and also due to a wider boundary separation, which indicates heightened cautiousness (Ratcliff, Thapar, & McKoon, 2006). It was also shown through this analysis that older adults are able to acquire the same quality of information as younger adults, indicating that their uptake of perceptual information occurs at a same rate as in younger adults.

Diffusion modeling has been successfully applied to experimental data in social psychology (e.g., Klauer, Voss, Schmitz, & Teige-Mocigemba, 2007) but never to regulatory focus paradigms. Its application in the current study may yield novel insights with respect to the specific perceptual components affected by regulatory focus and age.

Chapter 3: Experiment 1

3.1 Hypotheses

For experiment 1, there were several specific predictions. It was expected that the older adults would show typical age-related patterns of performance on the two cognitive tasks as compared with the younger adults. For the emotional memory task, younger adults should have significantly better performance than older adults; poorer free recall performance is a reliable age-related effect as referenced earlier. The effect of valence is of more interest however: younger adults should have improved memory for negative versus positive stimuli while the older adults should show a preference for positive over negative stimuli. This prediction was

based on substantial literature describing such an effect of valence with aging, and furthermore because the stimuli were selected from those used in another study that reported a positivity effect in older adults for non-arousing emotional words (Kensinger, 2008). It was unclear how regulatory focus and self-discrepancy as measured by the SST may interact with age to influence emotional memory performance. Larger self-discrepancies could enhance memory for negative words since having large discrepancies has been linked to negative affect, which in turn can bias information processing towards negative stimuli (e.g., Clark & Teasdale, 1985). In terms of chronic regulatory focus, a promotion focus should be associated with improved memory for the positive words while a prevention focus should lead to better memory for negative words, consistent with previous literature on regulatory focus and emotional processes (Idson, Liberman, & Higgins, 2000; Cunningham, et al., 2005). However, it was unclear if and how regulatory focus may interact with age. Of note, the prediction that older adults should show a positivity bias appears to oppose the subsequent predictions – namely that older adults should be more prevention focused and that a prevention focus should be associated with enhanced memory for negative words. Although all of these predictions are based on extensions of the existing literature, it is unclear how this apparent contradiction should be reconciled; this is an issue that will hopefully be clarified in the current experiment.

Concerning the visual perception task, it was expected that overall, younger adults should have shorter RTs than older adults. The older adults should demonstrate a stronger accuracy orientation compared with the younger adults, in terms of the speed-accuracy trade-off. In terms of the diffusion model, predictions were made for the three parameters (i.e., drift rate, boundary separation, and non-decision time) derived from the RT and accuracy data. Based on previous research, older adults should have larger mean non-decision time than younger adults, meaning

that they should require more time for processes such as stimulus encoding and the execution of motor responses. Older adults should also have larger mean boundary separation as a result of generally needing more information in order to commit to a decision. That is, they should demonstrate increased cautiousness compared with the younger adults. It was unclear if efficiency of information uptake, or drift rate, should differ between age groups; different types of perceptual tasks have been associated with different patterns (Ratcliff, Thapar, & McKoon, 2005; Spaniol, Voss, Bowen, & Grady, 2011). Regarding self-discrepancy, it was an open question if and how they may relate to the diffusion model parameters. However, for chronic regulatory focus, it was expected that a promotion focus should decrease boundary separation, since these individuals should prefer eager strategies, including prioritizing speed over accuracy. A prevention focus should augment the boundary separation since this type of focus is related to vigilance strategies, associated with increased cautiousness. It was unclear if the other parameters would be modulated by self-discrepancy or regulatory focus.

There were several predictions concerning the main outcome measure, the SST. For chronic regulatory focus, it was expected that the SST would show that as a whole, younger adults have a tendency to be promotion focused. Conversely, this task should reveal that the older adults tend to be prevention focused or at least balanced between both a promotion and prevention focus. Regarding self-discrepancy, it was hypothesized that older adults will exhibit less discrepancy between their actual and future selves as compared with the younger adults. Based on the literature reviewed earlier, older adults may rate their future selves lower than younger adults do, which may reflect reduced expectations as a result of a limited time perspective. There were no specific predictions about what types of self-attributes the participants will generate in the SST, as the qualitative analysis of this task was new territory.

However, according to the SOC framework, as well as previous research on personal goals (e.g., Riediger & Ebner, 2006), it was expected that the older adults would produce selves from fewer life-domains (i.e., goal focusing). Generally speaking, overall self-discrepancy magnitude should be related to emotional distress; this could be reflected in an association with the measure of psychopathology and/or the measure of negative affect that will be employed in the current research (the DASS or the negative subscale of the PANAS, respectively). More specifically, SDT predicts that larger ideal-actual self-discrepancies should be associated with depression-related emotions (as measured by the DASS subscale) while larger ought-actual self-discrepancies should be related to anxiety-related emotions instead (as measured by the DASS subscale).

3.2 Methods

Participants. Thirty-seven younger adults were recruited from the Ryerson University psychology database (SONA) and received one course credit for their participation in the study. Seven of these participants were excluded from the analyses due to a current psychiatric diagnosis, current prescription of psychiatric medication, a diagnosis of a learning disability, history of a symptomatic concussion or head injury, or being over the age of 30. Twenty-eight adults over age 65 also participated in the study; they were healthy, community-dwelling individuals recruited from Ryerson University's database of older adults and received $10 in compensation for their participation. These participants were screened over the phone prior to being accepting into the study. Exclusion criteria were the same as for the younger adults, and additional questions were asked about any difficulties seeing images or words on a computer screen. In addition, some of the older (N=6) and younger (N=4) participants did not complete

one of the experimental tasks (i.e., SST) correctly[3] (one older participant declined to complete it entirely) and were subsequently eliminated from the analyses. Analyses of the other experimental measures and demographic characteristics were then run with and without these select participants and there were no changes in the results. As such, the results described below are excluding the ten participants who had invalid data for the SST, making for a total of 26 younger and 22 older adults.

Procedure. Approval for the study was received from the Ryerson University Ethics Board. Upon entering the testing room, participants were asked for their informed consent. In addition to reading through the consent form, participants were verbally instructed about what the protocol involved and encouraged to ask questions about the procedure. Next, participants were administered the following pen and paper cognitive measures: Symbol Digit Coding and the Shipley Vocabulary Test (Shipley, 1940). The former was included to provide a baseline measure of processing speed, which was necessary in light of the visual perception task. The latter was included to provide an estimate of crystalized intelligence. Next, the Depression Anxiety and Stress Scale 21 (DASS-21; Lovibond & Lovibond, 1995) and the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1998) were given. Participants thenproceeded to the computer to complete the emotional memory task followed by the visual perception task and the self-strength task. Then they returned to the table to complete the second PANAS. The older adults were subsequently debriefed and compensated, while the younger adults were screened for basic demographic information before they were debriefed. Upon completion, all participants were thanked for their time.

[3] These participants responded too quickly on the ratings and thus skipped several of the ratings.

3.3 Materials

Baseline measures. Participants completed the Digit Symbol Coding, which is a measure of processing speed taken from the Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV), and the Shipley Vocabulary test, a commonly used multiple-choice test of crystalized intelligence (Shipley, 1940). Participants were also be given 2 self-report scales: the Depression Anxiety and Stress Scale 21 (DASS-21; Lovibond & Lovibond, 1995) and the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1998). The DASS measures and discriminates between the constructs of depression, stress, and anxiety. In addition, favourable psychometric properties have been demonstrated for its use in older adults (Gloster et al., 2008). The PANAS contains 2 scales comprised of 20-items that assess affect. High negative affect is characterized by subjective distress and negative engagement with the environment while high positive affect reflects high energy, full concentration, and pleasurable engagement with the environment (Watson, Clark, & Tellegen, 1998). The older adults were also administered the Mini-Mental Status Examination (MMSE; Folstein, Folstein, & McHugh, 1975) at the end of the testing session in order to screen for healthy cognitive functioning.

Emotional memory task. Building on the procedure described by Kensinger *et al.* (2002), participants viewed 30 words (10 positive, 10 negative, and 10 neutral) on a computer screen, one at a time for three seconds each. Stimulus presentation was controlled by E-Prime software (Psychology Software Tools, Inc.). In the instructions, participants were asked to view the words as if watching a television. They were not told that there would be a memory test, which was given immediately after all the stimuli were viewed (Charles, Mather, & Carstensen, 2003). The rationale for choosing passive viewing instructions and an incidental memory test was that these conditions encourage the use of natural, spontaneous encoding processes. Under

these conditions, age-related differences in emotional memory are more likely to emerge than under more constrained conditions featuring active, intentional encoding (e.g., Mather & Carstensen, 2006; Kensinger & Leclerc, 2009). The word list was acquired from Kensinger by email correspondence based on her 2008 study. The list included 10 positive, 10 negative, and 10 neutral words selected from the Affective Norms for English Words (ANEW; Bradley & Lang, 2009), which had been matched for arousal, length, frequency, and familiarity, and for absolute valence between the positive and negative sets (see Appendix; Kensinger, 2008). Further, all words were rated as low in arousal level (i.e., nonarousing). The neutral words were all semantically related to the concepts of "think" and "mind" because of concerns that emotional words are inherently semantically related, which may confer mnemonic advantages (Talmi et al., 2007). An absolute total score, as well as scores for each valence category, was calculated. Proportional scores were also calculated for each valence category in order to make comparisons between the older and younger groups possible, since absolute memory performance tends to decrease with age (e.g., Balota, Dolan, & Duchek, 2001). For instance, if 10 words were recalled overall and 3 had been rated as negative, the participant would receive 3/10 or 30% for the negative-subscale (Kensinger *et al.*, 2002). Intrusions were also tallied in order to measure the false positive rate.

Visual perception task. This task gives measures of low-level perceptual processes, specifically visual-motor perception, perceptual efficiency, and decision cautiousness (Kostova & Spaniol, 2013). Using E-Prime software (Psychology Software Tools, Inc.), participants viewed 192 images on a computer screen for up to 3 seconds, or until a response was made. Each image was fitted to a 200 x 200 pixel frame against a black background. Participants had to judge whether each image depicted an indoor or outdoor scene by pressing the corresponding

button on a keyboard (see Appendix). Underneath each image was written "indoor" and "outdoor", spatially corresponding to the appropriate button so that participants did not have to memorize which button was which. This response order was randomized across participants (e.g., right=indoor versus right=outdoor). Participants were also instructed to place equal emphasis on speed and accuracy, and to make their best guess if they were unsure about their answer. The difficulty of the perceptual task was modulated by varying the degradation of the images (low, medium, or high). This was achieved by replacing a percentage of the pixels (40, 60, or 80%) with gray-scale values. The modulation of degradation was important in order to prevent accuracy from reaching ceiling. Furthermore, the degradation variable served as a manipulation check regarding the influence of task difficulty on the diffusion parameters. The order of image presentation was randomized across participants. Participants' data were excluded from the analyses if they neglected to respond on more than 20% of the trials[4].

Self-guide strength & self-discrepancy task. This ideographic computerized task, taken from Higgins, Shah, and Friedman (1997), was designed to provide measures of chronic regulatory focus, as well as discrepancies between actual and future (ideal or ought) selves. E-Prime software (Psychology Software Tools, Inc.) was used for stimulus presentation and response collection. On each trial of the task, participants were asked to type an attribute of the person they would ideally like to be or an attribute of the person they ought to be. A total of eight trials were administered per participant in pseudorandom order. The ideal self was defined as "the type of person they would ideally like to be; the type of person they hoped, wished, or aspired to be", while the ought self was defined as "the person they ought to be; the person whose duty, obligation, or responsibility it is to be" (Higgins *et al.*, 1997). After providing each

[4] Incidentally, this subset of participants had already been excluded based on the primary exclusion criteria.

attribute, participants were asked to rate the attribute on 2 characteristics. First, they rated how much they would ideally like to (or ought to) possess the attribute: "For the last attribute, rate the extent to which you would IDEALLY LIKE TO possess the attribute". Next, they rated how much they actually possessed the attribute: "For the last attribute, rate the extent to which you believe you ACTUALLY possess the attribute". Participants made their ratings using a 4-point Likert scale (1=slightly; 2=moderately; 3=a great deal; 4=extremely). Participants were asked not to repeat any attributes, to respond as quickly and as accurately as possible, and to not spend too much time thinking about their answers ("just put what first comes to mind"). Thus, each of the 8 trials required 3 responses from participants: typing the attribute, rating 1, and rating 2.

The computer program recorded the participants' responses, as well as response latencies for typing the attribute and for each rating. Each participant thus produced 3 latencies per trial, which were then summed together. In the original study using this method (Higgins *et al.*, 1997), chronic regulatory focus was assessed by determining which type of attribute (ideal or ought) was more accessible as indicated by its relative response latencies. However, latencies in the current study were found to be highly variable (see Table 1); they covered a large range and there were many outliers. Indeed, it was observed by the experimenter that many participants, especially the older adults, had difficulties typing or incorrectly followed the task instructions: common errors included not remembering to respond quickly, making conversation with the experimenter during the task (usually about some aspect of the task, thus distracting their attention from responding as quickly as possible), or accidentally skipping one of the ratings altogether. This latter error occurred on several occasions especially with the older participants, who would then remark that they had pressed the wrong key by mistake. For example, several participants stated that they had pressed ENTER accidentally before making their rating, which

caused the program to skip to the next screen. Often, these participants would inform the experimenter that they had made an error or had missed a rating and so would indicate their intended rating to the experimenter afterwards. In these cases, the rating itself was deemed valid but the response latency was not. Combined with that fact that there were only eight trials per participant, the task was ultimately judged as an invalid measure of chronic regulatory focus. As such, chronic regulatory focus could unfortunately not be evaluated as originally planned. The analyses therefore focused on the discrepancy measures (Higgins et al., 1997). To calculate the actual-ideal discrepancy, the actual-self ratings were subtracted from the ideal-self ratings for each ideal attribute listed, and these values were them summed across all ideal trials. The actual-ought discrepancy was calculated in the same way. The 2 discrepancy values were also summed together for a total discrepancy score.

Additional qualitative analyses were also performed on the self attributes generated by the participants in this task. Although qualitative analyses have been performed with a related measure, the face-to-face Possible Selves Interview (Hooker 1992; designed after Cross & Markus, 1991), none have been conducted with the content from the SST to our knowledge. The analysis was deemed to be important since the SST indeed elicits a rich amount of qualitative data alongside the quantitative information. As this is a relatively novel analysis however, it is rather exploratory in nature. First, all of the attributes listed by all participants were viewed to get an overall sense of the data. The attributes were then read again, with the intention of identifying overarching themes. This search for themes was guided by the coding scheme from the Possible Selves interview. However, that coding scheme could not be directly applied due to differences between the tasks, as described earlier. For example, responses in the SST are constrained to single words, whereas in the interview, responses are full sentences. The

interview also asks about possible feared selves (instead of ought selves), which elicits themes that were not apparent in the SST. Several themes were identified and after several re-readings of the attributes, these themes were distilled into eight categories:

i. Achievement Product: These attributes represent end-points or fixed goal states, such as 'successful' or 'well-known'.

ii. Achievement Process: These attributes denote a more continual orientation towards achievement rather than a measurable end-point. Examples include 'motivated' or 'determined'.

iii. Mind/Cognitive: These attributes refer to mental or cognitive goals, such as 'wise' or 'intelligent'.

iv. Dispositional: Attributes in this domain describe individual character traits like 'happy' or 'calm' or 'genuine'.

v. Interpersonal Conscientiousness: This category includes attributes that involve benevolence or some type of positive orientation towards others, such as 'caring' or 'loving' or 'loyal'.

vi. Interpersonal Positive Regard: Attributes coded for this feature are those that involve a positive evaluation by others, like 'leader' or 'admired' or 'pretty'.

vii. Duties/Obligations: These attributes refer to qualities that are typically viewed as 'oughts' or 'shoulds'. For instance, 'upstanding', 'polite', or 'organized' were included in this category.

viii. Physical Health: The final domain encompasses references to physical health or well-being, like 'fit' or 'healthy'.

All of the attributes were then coded for one of the eight categories. Some attributes can conceivably fit more than one category. These attributes have been noted and will require broader discussion and consensus in the future with multiple raters. It is acknowledged that this is but one system for categorizing the qualitative data; there would certainly be conceptual disagreements in classifying attributes within this system. Further, it is clear that this system is shaped by the particular cultural, socioeconomic, and theoretical orientations of the author. As such, this represents merely a preliminary step towards developing a reliable system of qualitative analysis of the SST.

3.4 Analyses

Demographic variables as well as the results from the baseline cognitive measures were analyzed for group differences using *t* tests and chi square tests. The data from the emotional memory task were submitted to mixed analyses of variance (ANOVAs) and followed up with *t* tests. The ANOVAs included age (young, older) as a between-subjects factor and valence (positive, negative, and neutral) as a within-subject factor.

Participants' responses to the visual perception task were analyzed with EZ-diffusion modeling (Ratcliff, 1978; Wagenmakers, van der Maas, & Grasman, 2007). Performance on a two-choice perceptual decision task can be described in terms of speed and accuracy, but these are not "pure" measures of perceptual processes. EZ-diffusion modelling allows for the separation of perceptual, decisional, and motor components, each of which may be differentially affected by factors such as age and goal orientation. The model assumes that perceptual information accumulates towards one of two decision boundaries that represent the two response options (i.e., "indoor" and "outdoor" responses in the current study).

There are 3 parameters of the EZ-diffusion model: boundary separation, the drift rate, and nondecision time. These parameters are derived from the means and variances of reaction times, and the proportion of correct responses (i.e., accuracy). The separation between the two boundaries reflects the speed-accuracy trade-off, or how cautious an individual's response style is. For example, a larger separation indicates more caution, since more information must accumulate before a response threshold is reached. A narrow boundary corresponds to faster but more error prone decision making. Older adults tend to have significantly wider boundaries than younger adults (Spaniol, Voss, & Grady, 2008; Starns & Ratcliff, 2010), consistent with the idea that older adults are more cautious. The drift rate, or *v*, provides an index of perceptual efficiency, or how efficient the participant is at extracting information from a stimulus. Finally, the nondecision component *t* can include processes such as encoding and motor responses. The diffusion model parameters were calculated for each participant and experimental condition. Each parameter was then submitted to a 2 (age) by 3 (degradation level) mixed ANOVA.

The ratings and the discrepancy scores from the SST task were each also analyzed for group differences using ANOVAs and t tests. Relationships between these values and the various outcome measures were explored using bivariate correlations, followed by a series of separate multiple regressions with both age group and the SST outcomes (i.e., discrepancy scores and the self-ratings, respectively) entered simultaneously into separate models.

For the qualitative analysis, each of the attributes produced by the SST task was given a code. Next, the number of attributes in each coding domain was counted separately for each participant. These frequency counts were then submitted to a generalized linear model assuming a Poisson distribution. Age group was used as the predictor and the frequencies of the various code domains were entered as the dependent variables.

All analyses employed the Bonferroni corrections for multiple comparisons and any violations of sphericity were corrected using the Greenhouse Geisser correction factor. The alpha level was set to .05 and all tests were two-tailed.

3.5 Results

Baseline measures. The groups of older and younger adults did not differ with respect to sex or proportion of native English speakers (see Table 2). All older adults had MMSE scores of 27 or greater (M = 28.77; SD = 0.87)[5]. Older adults had significantly more years of education and displayed better performance on the Shipley Vocabulary test. Younger participants were significantly more proficient at Digit Symbol Coding and also exhibited significantly higher scores on all DASS subscales, indicating more mood, stress, and anxiety symptoms in this group (see Table 3). Correlations performed within each group of participants showed that these demographic measures did not significantly correlate with any of the experimental tasks.

To explore any group differences in affect before and after the main experimental tasks, separate mixed ANOVAs were performed on the two subscales (i.e., positive and negative affect) of the PANAS (see Table 4). Concerning positive affect, there was no significant main effect of time (pre/post), and no significant interaction between time and age, suggesting that both groups did not experience significant change in positive affect during the experimental session. However, there was a significant effect of group, $F(1,46) = 17.30$, $p < .001$, $\eta_p^2 = .27$, which was explained by the fact that the older adults reported significantly greater positive affect than the younger adults at both time points (the mean difference was 6.91 points prior to the experiment and 7.70 points after).

[5] For an educated sample, scores of 26 or below may be indicative of cognitive impairment.

For negative affect, there was also no main effect of time but there was a significant Time X Age interaction, $F(1,46) = 5.56$, $p = .023$, $\eta_p^2 = .11$, as well as a main effect of group, $F(1,46) = 8.75$, $p = .005$, $\eta_p^2 = .16$. Follow-up ANOVAs showed that younger adults displayed greater negative affect prior to the main experimental tasks (mean difference of 3.56 points), but afterward, there was no significant difference between age groups (mean difference of 1.49 points).

Emotional memory. In the emotional memory task, the older adults exhibited typical age-related decrements in performance compared with the younger adults. That is, they had significantly worse overall recall, $t(46) = .431$, $p < .001$, and also had a tendency to report more false memories than the younger adults (see Table 5). Because absolute performance was worse than in the younger adults, $F(1, 46) = 18.55$, $p < .001$, $\eta p^2 = .29$, proportions rather than absolute numbers of words recalled were used to investigate the effect of valence on memory. A mixed ANOVA indicated a significant main effect of valence, $F(2, 92) = 10.10$, $p < .001$, $\eta p^2 = .18$, but no significant Valence X Age interaction. The pairwise comparisons revealed that the main effect of valence was driven by significantly better recall for negative compared with positive ($p = .006$) and neutral words ($p < .001$), but there was no significant difference in recall between positive and neutral words. Thus, in contrast to several other studies, including Kensinger (2008; see also Denburg, Buchanan, Tranel, & Adolphs, 2003; Murphy & Issacowitz, 2008), the older adults demonstrated a negativity effect, which is usually characteristic of younger (but not older) adults (depicted in Figure 1).

Visual perception. Accuracy and RT results are presented first to provide a picture of overall task performance. EZ-diffusion model parameters, calculated from the accuracy and RT means and variances, are presented next. For each of the measures, mixed ANOVAs with age as

the between-subjects variable and stimulus degradation as the within-subjects variable are reported.

Accuracy. A significant main effect of degradation emerged, F (2, 92) = 114.33, p < .001, ηp^2 = .71, and all pairwise comparisons between degradation levels were significant (shown in Figure 2). In addition, there was a significant Age X Degradation interaction, F (2, 92) = 6.58, p = .002, ηp^2 = .13, and a significant effect of age, F (1, 46) = 5.39, p = .025, ηp^2 = .11. Follow-up ANOVAs at each degradation level showed a significant effect of age at the lowest degradation level only, F (1, 46) = 10.25, p = .002, ηp^2 = .18, whereby the older adults were significantly less accurate than the younger adults.

Reaction time. A significant main effect of degradation was found, F (1.67, 76.82) = 12.26, p < .001, ηp^2 = .21, but no significant interaction with age (see Figure 3). There was however a main effect of age, F (1, 46) = 10.06, p = .003, ηp^2 = .18. Follow-up ANOVAs showed that older adults were significantly slower than the younger adults at each degradation level: lowest, F (1, 46) = 11.95, p < .001, ηp^2 = .21, intermediate, F (1, 46) = 7.68, p = .008, ηp^2 = .14, and highest, F (1, 46) = 8.37, p = .006, ηp^2 = .15.

Diffusion modelling. The accuracy and RT values were subsequently submitted to the diffusion model analysis to derive the three parameters. Univariate statistics were performed with these parameters in order to test our specific hypotheses.

Drift rate. Again, a significant main effect of degradation was found, F (2, 88) = 112.93, p < .001, ηp^2 = .72, whereby drift rates were inversely related to degradation level (see Figure 4). All pairwise comparisons for this variable were significant. There was a significant Degradation X Age interaction, F (2, 88) = 7.44, p = .001, ηp^2 = .14, as well as a trend towards a significant

main effect of age, F (1, 44) = 3.82, p = .057, ηp^2 = .08. Follow-up ANOVAs performed at each degradation level indicated a significant age difference (i.e., older adults had lower drift rates, or less proficient accumulation of information, than the younger adults) only for the least degraded images, F (1, 45) = 9.33, p = .004, ηp^2 = .17.

Boundary separation. The ANOVA produced a significant main effect of degradation, F (2, 88) = 25.65, p < .001, ηp^2 = .37, in addition to a significant Age X Degradation interaction, F (2, 88) = 5.32, p = .007, ηp^2 = .11 (see Figure 5). There was a trend toward a significant main effect of age, F (1, 44) = 3.31, p = .076, ηp^2 = .07, which was driven by a significant age difference at the lowest degradation level, F (1, 45) = 7.24, p = .010, ηp^2 = .14. At this degradation level, older adults had significantly lower values (narrower boundaries) for this parameter than did younger adults. Follow-up ANOVAs at the medium and high degradation levels showed no significant age differences.

Non-decision time. Results showed a significant main effect of degradation, F (1.63, 71.53) = 14.31, p < .001, ηp^2 = .25, but no significant Age X Degradation interaction (see Figure 6). There was a significant main effect of age however, F (1, 44) = 21.95, p < .001, ηp^2 = .33, and follow-up ANOVAs showed that this was explained by a significant age differences at each degradation level (low, F (1, 45) = 31.93, p < .001, ηp^2 = .42; medium, F (1, 46) = 14.90, p < .001, ηp^2 = .25; high, F (1, 46) = 13.92, p = .001, ηp^2 = .24). Thus, older adults had significantly larger values of this parameter compared with younger adults for all levels of difficulty.

Self-strength and self-discrepancy task. The results from the demographic and affective baseline measures, as well as the two cognitive tasks, suggested that on the whole, the samples represent typical groups of healthy younger and older adults, in terms of overall performance on the baseline, memory, and perception measures. As such, the following analyses

of the SST were conducted and assumed to be valid assessments of self-discrepancy in older and younger adults.

Quantitative analyses. This task provided several outcomes: mean ratings for how much participants hoped to (i.e., ideal trials) or believed they should (i.e., ought trials) possess the attribute they had typed (i.e., future self-ratings, which could range from 1 to 4), mean ratings for how much the participants believed they currently possessed the attribute (i.e., actual self-ratings, which could also range from 1 to 4), and the discrepancy scores between the future and actual ratings. There was one discrepancy score for the ideal trials and another for the ought trials (see Table 6).

Bivariate correlations were performed for evidence of discriminant validity of ideal and ought ratings and discrepancies, respectively. Future ratings for the ideal attributes were significantly correlated with the future ratings for the ought attributes, $r = .56$, $p < .001$, and actual ratings for the ideal attributes were also significantly related to actual ratings for the ought attributes, $r = .36$, $p = .011$. The ideal discrepancy score was significantly correlated with the ought discrepancy score, $r = .49$, $p < .001$. Paired *t*-tests showed no significant within-group differences for the ideal or ought discrepancy scores. Moreover, there was no significant age difference for the ideal discrepancy scores, $F\ (1, 46) = .65$, $p = .42$, $\eta_p^2 = .01$, or the ought discrepancy scores, $F\ (1, 46) = .14$, $p = .70$, $\eta_p^2 = .003$. These results raise concerns about the discriminant validity of these constructs.

To investigate the affective predictions of the SDT, a series of regression analyses were performed. The predictors were age group and the discrepancy scores and the dependent variables were the DASS and PANAS subscales. Age ($\beta = -0.44$, $p = .001$) and the ideal discrepancy scores ($\beta = -0.31$, $p < .05$) emerged as significant predictors of the DASS depression

subscale (overall model fit: $R^2 = 0.23$). Neither the ideal or ought discrepancy scores significantly predicted any of the other DASS or PANAS subscales. The three types of memory scores (i.e., positive, negative, neutral) were also analyzed with regressions, and one significant outcome emerged: the ought discrepancy scores ($\beta = -0.33$, $p < .05$) but not age were significant predictors of the proportion of neutral words recalled (overall model fit: $R^2 = .07$).

Because of concerns about the interrelatedness between the ideal and ought self-types for both the ratings and the discrepancies, scores were then collapsed across the ideal/ought dimension, leaving only 3 outcomes: future self-ratings, actual self-ratings, and overall discrepancy scores.

To explore age differences between the ratings, a repeated-measures ANOVA was performed with time (future vs. actual) and age (young vs. old) as the within- and between-subjects variables, respectively. There was a significant main effect of time, F (1, 46) = 125.14, $p < .001$, $\eta_p^2 = .73$, indicating that participants indeed hoped to or believed they ought to possess their generated attributes more than they actually possessed them. There was no significant time by age interaction, but there was a significant main effect of age, F (1, 46) = 9.32, $p = .004$, $\eta_p^2 = .17$. Follow-up ANOVAs revealed that for both the future, F (1, 46) = 7.81, $p = .008$, $\eta_p^2 = .15$, and actual ratings, F (1, 46) = 4.91, $p = .032$, $\eta_p^2 = .10$, older adults on average made lower ratings than younger adults. That is, they hoped or believed they ought to possess the self-relevant attributes less than younger adults did, but they also believed that they actually possessed the attributes less than the younger adults did.

Concerning the overall discrepancy (i.e., ideal and ought discrepancies combined) between future and actual selves, the ANOVA showed that there was no significant difference between age groups. Thus, despite the fact that older adults generally made lower ratings

compared with younger adults, the difference between the future and current ratings did not appear to change in magnitude with age. There were no significant correlations between overall discrepancy scores and any of the baseline or main outcome measures (i.e., PANAS, memory or perception). The same series of regression analyses was run, and only one resulted in a significant model: age ($\beta = -0.41$, $p < .01$) and overall discrepancy scores ($\beta = -0.27$, $p < .05$) were significant predictors of the DASS depression subscale only (model fit: $R^2 = 0.21$). This is the same pattern that was found with respect to the ideal discrepancy scores describe earlier.

Qualitative Analyses. Eight domains were ultimately established that appeared to capture the self-attributes generated in the SST. Table 7 lists the number (which is also converted to percentages) of attributes produced per domain in each age group. Figure 7 illustrates these values visually.

For both groups, the greatest proportion of attributes came from the interpersonal conscientiousness category (young = 27.5%; older = 33.1%). In the younger adults, the next most frequent categories were: achievement process (15.0%; e.g., "focused"), and achievement product (14.5%; e.g., "successful"), and dispositional (14.5%; e.g., "happy"). For the older adults, the next most frequent categories were: duties/obligations (21.51%; e.g., "tolerant") and mind/cognitive (11.6%; e.g., "educated").

Each of the coding domains was submitted to the generalized linear model using a Poisson distribution. These results (listed in Table 8) suggest that three of these domains evince significant age group differences: achievement product, duties/obligations, and physical. That is, the younger adults generated significantly more attributes characteristic of achievement product compared with older adults, whereas older adults produced significantly more attributes than younger adults in the duties/obligations and physical domains.

In sum, the baseline cognitive and affective measures demonstrated that the age groups differed in expected ways: the older adults were more educated, had higher vocabulary scores, but lower levels of processing speed compared with the younger adults. Older adults reported significantly higher levels of positive affect both before and after the experiment whereas the younger adults experienced more negative affect before the experiment only. In terms of the experimental measures, the older adults recalled significantly fewer words than the younger adults, as predicted. Contrary to expectations, both age groups demonstrated a negativity effect whereby negative words were remembered relatively better than both positive and neutral words. In the visual perception task, the older adults diverged from the younger adults on some variables. They were less accurate and had lower drift rate and boundary separation values at the lowest degradation level only. They also produced longer RTs and larger non-decision time values at all degradation levels as compared with the younger adults. Finally, despite the fact that the older adults made lower ratings for both current and future selves on the SST, the magnitude of self-discrepancies did not significantly differ between age groups. The qualitative analyses revealed that for both age groups, the greatest proportion of self-attributes were representative of the interpersonal conscientiousness category. Significant group differences were found in the achievement product, duties/obligations, and physical categories.

Chapter 4: Experiment 2

4.1 Hypotheses

It is expected that the three groups should not significantly differ from each other on any of the baseline cognitive and affective measures. However, there are several hypotheses with respect to how the regulatory focus induction should affect performance on the two main cognitive tasks. Concerning emotional memory performance, while younger adults should

display a negativity effect overall, it is expected that the regulatory focus induction will modulate this effect. In particular, it is expected that the prevention focus induction should enhance memory for negative words even more, while the promotion focus induction should decrease the negativity effect, perhaps by improving memory for positive words. The basis for these predictions is that on the one hand, a promotion focus involves concerns with rewards, aspirations, and gains, which are typically positive stimuli. On the other hand, a prevention focus deals with duties and obligations, which are often negative in nature. As such, it is conceivable that being primed towards a particular regulatory focus could bias emotional processing towards valence-congruent stimuli. Indeed, neuroimaging studies have found evidence enhancement of activity in specific brain regions when there is congruence between regulatory focus and stimuli. For instance, Cunningham and colleagues (2005) found that precuneus activity increased according to degree of trait promotion focus when participants viewed positive stimuli in the scanner. Furthermore, amygdala activity increased in individuals with trait promotion focus when their viewed positive stimuli, while the opposite pattern was found between trait prevention focus and negative stimuli, suggesting more effective processing when there is a fit between motivational orientation and stimuli.

With respect to the visual perception task, the predictions are the same as in Experiment 1: the promotion induction should be associated with decreased boundary separation compared with the controls since these individuals should be less cautious in their decision making. In contrast, the prevention induction should lead to a larger boundary separation versus controls; these individuals should prioritize accuracy over speed. Promotion focused younger adults should be more perceptually efficient than those in a prevention focus; they should be faster in their information uptake, reflecting eagerness-related strategies. Promotion focused individuals

could show reductions in non-decision time if the manipulation serves to increase impulsiveness, but this prediction is less strong. Finally, no *a priori* hypotheses were advanced regarding the effects of the induction on drift rate.

4.2 Methods

Participants. One-hundred and five younger adults were recruited from the Ryerson University psychology database (SONA) and received one course credit for their participation in the study. Twenty-one of the total number of participants were excluded from the analyses due to a current psychiatric diagnosis, current prescription of psychiatric medication, a diagnosis of a learning disability, history of a symptomatic concussion or head injury, or being over the age of 30. All participants were randomized into the three experimental conditions. Since participants were excluded after participation, the final number of participants in each group was: 26 in the ideal group, 28 in the ought group, and 30 in the control group. The participants in the latter group are the same individuals described alongside the older adults in Experiment 1.

Procedure. The experimental procedure is almost identical to that in Experiment 1 (see Figure 8). Participants began by giving informed consent, after which they completed the same paper and pencil baseline tasks described earlier. However, the participants in both of the experimental groups (i.e., ideal or ought) then underwent the regulatory focus induction (Freitas & Higgins, 2002) while those in the control group proceeded directly to the memory task. The induction involved writing an essay about either one's hopes and aspirations (ideal condition) or one's duties and responsibilities (ought condition). After the essay, these participants proceeded to the computer to complete the emotional memory task as well. At this point, participants in the control condition performed the visual perception task, while those in the induction conditions were first asked to re-read their essays and provide any additional information that came to mind,

with the aim of deepening and reinforcing the induction. After this procedure, they also completed the perception task. Once the perception task was completed, participants in the induction groups were given the second PANAS, while those in the control group completed the Self-Strength and Self-Discrepancy (SST)[6] task before they completed the second PANAS. Finally, participants were interviewed by the administrator to acquire basic demographic information (i.e. age, education, languages spoken, medical conditions, and current prescription medications), were debriefed about the purposes of the experiment, and thanked for their contribution.

4.3 Materials

Baseline measures. All participants completed the Symbol Digit Coding task, the Shipley vocabulary test, the DASS 21, and the PANAS, all described in Experiment 1.

Main outcome measures. All participants performed the emotional memory task and the visual perception task, identical to those administered in Experiment 1. Participants in the control condition also completed the SST, as described earlier.

Regulatory focus induction. Participants in both of the experimental groups completed the regulatory focus induction (Freitas & Higgins, 2002). The induction involved priming individuals to enter a particular regulatory state, either promotion or prevention (Freitas & Higgins, 2002). More specifically, participants wrote for approximately 5-10 minutes in response to certain questions (modified from Freitas & Higgins, 2002) about their ideal (hoped or aspired for) goals/selves to elicit a promotion focus, or their ought to goals/selves (duties, obligations, or responsibilities) to elicit a prevention focus. Through writing, the particular focus

[6] Although the participants in the control group performed this task in this session, the results are not reported below since they were already described in Experiment 1.

is theorized to become more accessible (Freitas & Higgins, 2002). The *ideal* priming instructions read:

> For this task, we would like you to think about your current hopes and aspirations. In the space below, please write a brief essay describing what accomplishments you hope to achieve in the near future. (You have approximately 7-10 minutes.)

The *ought* priming instructions state:

> For this task, we would like you to think about your current duties and obligations. In the space below, please write a brief essay describing what responsibilities you ought to meet in the near future. (You have approximately 7-10 minutes.)

As there is no empirical evidence to indicate how long the induction effects may persist, participants were asked to reread their essays and add any additional information after completing the memory task. This second step was added with the aim of maintaining the induction.

4.4 Analyses

The same statistical procedures were followed as in Experiment 1 except experimental group was used as the between-subjects variable (i.e., ideal, ought, control). Mixed ANOVAs were run for measures obtained from both the emotional memory task and the visual perception task. Any violations of sphericity were corrected with the Greenhouse Geisser factor, and follow-up comparisons employed the Bonferroni correction. The alpha level was set to .05 and all tests were two-tailed.

4.5 Results

Baseline measures. Participant characteristics are described in Tables 9 and 10. No significant group differences were found for years of education, distribution of males and females, or proportion of group members with English as a first language. Likewise, there were no differences in Digit Symbol Coding, the Shipley Vocabulary test, or the total DASS scores. There was however a significant difference on the anxiety subscale, which was explained by a

significant difference between the ideal (M = 6.85, SD = 4.89) and ought (M = 3.96; SD = 3.81) groups only (p = .032). This subscale did not correlate with any of the major outcome variables and as such, this difference is not assumed to be of major significance.

Concerning current affect as measured by the PANAS (see Table 11), a mixed ANOVA carried out on the positive subscales revealed a significant effect of time (pre/post), F (1, 81) = 34.84, $p < .001$, $\eta_p^2 = .30$, as well as a significant Time X Group interaction, F (2, 81) = 4.04, p = .021, $\eta_p^2 = .09$. There was also a significant main effect of group, F (2, 81) = 4.27, p = .017, η_p^2 = .10. Follow-up ANOVAs showed that this was accounted for by significant group differences during the second administration (post) only, F (2, 81) = 6.33, p = .003, $\eta_p^2 = .14$. Here, both experimental groups reported significantly lower positive affect than the control group, but they did not differ from each other. Likewise, paired *t*-tests carried out within each group showed that the ideal and ought groups experienced a significant decrease in positive affect from pre to post (p = .002 for ideal and $p < .001$ for ought) while the control group did not.

As regards the negative subscale, the mixed ANOVA indicated a significant main effect of time, F (1, 81) = 6.76, p = .011, $\eta_p^2 = .08$, and group, F (2, 81) = 3.31, p = .042, $\eta_p^2 = .08$, but no significant interaction. The pairwise comparisons between groups were not significant however (ideal versus ought, p = .094; ideal versus control, p = .072). Indeed, separate follow-up ANOVAs for the pre and post scores did not produce a significant between-subjects effect (pre, p = .080; post, p = .076). Thus, although the ideal group tended to be associated with lower scores on this PANAS subscale (indicating less negative affect), this group difference did not remain significant beyond the main omnibus test.

Emotional memory. A Group X Recall ANOVA performed on the overall recall scores did not reveal a significant difference between groups, F (2, 81) = .51, p = .604, $\eta_p^2 = .01$ (see

Table 12). A mixed 3x2 ANOVA was then carried out on the proportions[7] of emotional words remembered in order to explore the effect of valence (see Figure 9). The analysis revealed a significant main effect of valence, F (2, 162) = 9.60, $p < .001$, $\eta_p^2 = .11$, and a significant Valence X Group interaction, F (4, 162) = 2.96, $p = .022$, $\eta_p^2 = .07$, but no significant effect of group. Follow-up pairwise comparisons showed that on the whole, neutral words were remembered less well compared with both positive ($p = .024$) and negative words ($p < .001$). However, there was no significant difference between positive and negative words ($p = .481$), indicating that emotional words were associated with significantly better overall recall.

To understand the significant interaction, separate ANOVAs were run for each level of valence. There was no significant group difference for the recall of negative, F (2, 81) = 1.91, $p = .154$, $\eta_p^2 = .05$, or positive words, F (2, 81) = 2.76, $p = .070$, $\eta_p^2 = .06$. For neutral words, there was a main effect of group, F (2, 81) = 4.22, $p = .018$, $\eta_p^2 = .09$. This was explained by the fact that those in the ideal group showed significantly better recall for neutral words compared with the other groups ($p = .039$ for both pairwise comparisons). Indeed, repeated measures ANOVAs run for each group separately indicated that there was a significant effect of valence in both the ought and control groups (with neutral words remembered significantly less well than either type of emotional words), whereas in the ideal group, there was no significant effect of valence.

Visual perception. As in Experiment 1, the accuracy and reaction time results are reported first, followed by the analyses conducted with the diffusion model parameters.

Accuracy. A 3x2 mixed ANOVA was performed to investigate any group differences in accuracy (see Figure 10). The analysis showed a significant main effect of degradation, F (1.75,

[7] Rather than absolute scores, in order to be consistent with Experiment 1. For confirmation, the analyses were also conducted with the absolute scores and the results were unchanged (although they are not reported here).

141.73) = 228.12, $p < .001$, $\eta_p^2 = .74$, and a significant Degradation X Group interaction, F (3.50, 141.73) = 4.17, $p = .005$, $\eta_p^2 = .09$, but no significant effect of group. To explain the interaction, follow-up ANOVAs were carried out. Results showed that at the lowest degradation level, there was a significant main effect of group, F (2, 81) = 3.31, $p = .042$, $\eta_p^2 = .08$. The pairwise comparisons revealed a trend towards a significant difference between the ideal and control groups, with the former tending to be less accurate than the latter ($p = .05$).

Reaction time. Here there was again a significant main effect of degradation, F (1.73, 140.23) = 50.62, $p < .001$, $\eta_p^2 = .39$, but no significant interaction or group effect (see Figure 11).

Diffusion modelling.

Drift rate. The analyses for this parameter also demonstrated a significant main effect of degradation, F (2, 156) = 192.37, $p < .001$, $\eta_p^2 = .71$, and a significant degradation by group interaction, F (4, 156) = 2.54, $p = .041$, $\eta_p^2 = .06$ but no significant main effect of group (see Figure 12). However, none of the follow-up ANOVAs revealed any significant effects of group at any of the degradation levels.

Boundary separation. The repeated measures ANOVA resulted in a significant main effect of degradation, F (1.85, 144.63) = 42.74, $p < .001$, $\eta_p^2 = .35$, a significant degradation by group interaction, F (3.71, 144.63) = 5.12, $p = .001$, $\eta_p^2 = .11$, but again, no main effect of group (see Figure 13). An ANOVA was performed at the lowest degradation level, which revealed a significant group effect, F (2, 79) = 5.15, $p = .008$, $\eta_p^2 = .12$, which was driven by the difference between the ideal and control groups (ideal < control; $p = .009$).

Non-decision time. This parameter was associated with a significant main effect of degradation, $F(1.833, 142.965) = 33.78$, $p < .001$, $\eta_p^2 = .30$, but no significant interaction or effect of group (see Figure 14).

Chapter 5: Discussion and Summary

This section will address the results from Experiments 1 and 2, respectively. This will be followed by a description of the limitations of these experiments and conclude with suggestions for future research.

Experiment 1

In general, recall performance was consistent with the published research on aging and memory. The older adults had significantly worse overall memory compared with the younger adults. Of greater interest however was the effect of valence on performance. Consistent with the literature (e.g., Buchanan & Adolphs, 2002), participants generally demonstrated an emotion salience effect in that they had enhanced memory for negative words in comparison to neutral words. At the same time, although memory for positive words was generally better than for neutral words as well, this difference was not significant.

Contrary to the original hypothesis, memory of the older adults was affected by valence in the same way as were the younger adults. That is, the older adults also demonstrated a negativity effect. This result was surprising in light of the many studies that have tended to find a positivity effect in older adults, which is explained by SEST predictions. More importantly however, the stimuli employed in the current experiment were taken from a study (Kensinger, 2008) that specifically found such a positivity effect. In that study, negative words were remembered better than positive words by the younger adults whereas the older adults

remembered the positive words the best, while negative and neutral words were equally memorable. Moreover, all words used in Kensinger's study (and in the current experiment) were non-arousing words, according to published norms. Compared with arousing words, memory for non-arousing words is presumed to demand more controlled processing, and it is specifically this type of processing that supposedly fosters the positivity effect (Mather & Carstensen, 2005).

Why the results from the current experiment diverge from Kensinger's results is difficult to account for. The sample of participants differed only slightly between studies. The younger adults in Kensinger's study were slightly older (M = 26.1) and more educated (M = 16.3) than those in the current study (M = 19.5 and M = 12.8, respectively). Also, the younger adults were recruited from the community in Kensinger's study while in the current study, the younger adults participated for course for credit. However, the sample of older adults in Kensinger's study were of similar age (M = 73.5) and education level (M = 16.7) compared with those in the current study (M = 73.4 and M = 15.8, respectively). Further, the older adults in both studies were recruited from community.

Another possible explanation for the divergent results is that the paradigm used in the current study different slightly from that used by Kensinger. Participants in the latter study viewed 75 words for five seconds each, and the words covered five different categories of 15 words each: neutral, negative non-arousing, positive non-arousing, negative arousing, and positive arousing. Participants were aware of the upcoming memory test and they also performed an encoding task where they rated words as "abstract" or "concrete". The Kensinger study also included a follow-up experiment using incidental instructions but with a recognition test instead, and the results were the same. In the current experiment, there was no encoding task, participants viewed 30 words for three seconds each, and were given an unexpected free

recall test. Because fewer words were viewed in the current study, only a subset of the original list of stimuli used by Kensinger was used. As such, the current selection of stimuli differs slightly from Kensinger's. Still, the mean valence and arousal values did not significantly differ from Kensinger's lists[8]. Although Kensinger found that the positivity effect generalized across both paradigms, the effect did not extend as far as the current experiment for unknown reasons.

On a more general level, despite the popularity of socioemotional selectivity theory and the empirical support it has received, the positivity effect is not universally found in all measures of memory and attention. A recent meta-analysis by Murphy and Isaacowitz (2009) showed that while emotion salience effects were reliable, there is evidence for both positivity and negativity effects, with few age differences. In light of this meta-analysis, results from the current experiment are not atypical.

Regarding the test of visual perception, some of the results agreed with the hypotheses, although these generally occurred at the lowest degradation levels only. Performance at the medium and highest degradation levels tended not to differ between age groups. Older adults were less accurate than the younger adults at this level only; when task difficulty increased, there were no significant age differences in accuracy. However, older adults did take significantly longer to make their responses to images at all levels of degradation, which was expected. Diffusion modeling extended these findings: on average, older adults had significantly lower drift rate and boundary separation values compared to younger adults at the lowest degradation level only. That is, they were less efficient at perceiving information and were also less cautious. When task difficulty increased however, there were no significant differences in these parameters between age groups. One possibility for this lack of difference is that the perception of the images became too difficult at these higher degradation levels, thus levelling off any effect

[8] Statistics not reported here.

of age. Indeed, the fact that the older adults presented higher boundary separation values (which reflects prioritization of speed over accuracy) than the younger adults supports this speculation. This finding is contrary to expectations. Earlier literature using diffusion modelling to interpret performance on visual perception tasks[9] has generally found that older adults require more information than younger adults in order to make a decision, which is reflected in higher boundary separation values (e.g., Ratcliffe, Thapar, McKoon, 2005). Evidence for age differences in drift rate are mixed however, with some studies finding no difference in perceptual efficiency while others have found older adults to be worse than younger adults (e.g. Ratcliffe et al., 2005).

Concerning the third parameter of non-decision time, the age groups differed at every degradation level: older adults took longer to perform non-decision related processes such as stimulus encoding and the execution of motor responses. This finding was expected based on previous literature describing the slowing of motor processes with aging. In summary, although the results from the emotional memory and visual perception tasks deviated from some of the predictions, in a general sense, typical performance patterns associated with aging emerged, suggesting that the samples were characteristic of younger and older adults.

Results from the self-strength task (SST) were mixed. Unfortunately, the intention to measure chronic regulatory focus using this measure was hindered by invalid reaction time data. The noise was judged to be too substantial for valid interpretation; there were simply too many problems in task performance, especially with the older adults who exhibited difficulties with typing and just generally following portions of the task instructions. Nevertheless, the self-attributes themselves as well as the ratings appeared to be valid for interpretation. Regarding the task, some modifications could perhaps be made in order to make it more valid. Practice trials

[9] However, these tasks differ from the one used in the current study.

could have be included for instance, but participants could be asked to generate attributes describing the ideals or oughts of loved ones for instance, in order to ensure that participants do not exhaust their repertoire of attributes for themselves prior to the actual trials.

Correlational analyses between the ideal and ought discrepancies and ratings suggested significant amounts of interrelatedness between these constructs in both age groups. Subsequent analyses did not reveal any significant differences within or between groups between the two self types (ideal or ought). It is unclear if this is a flaw of the instrument or if there are indeed no true differences between these constructs. In fact, some researchers of regulatory focus have raised similar concerns about the validity of the instruments purported to capture differences between ideal and ought selves, but also with respect to the theoretical constructs themselves (Ozgul, Heubeck, Ward, & Wilkinson, 2003). SDT predicts that each self-type, ideal or ought, should differentially be associated with particular affective states (Higgins, 1987). Some studies have supported this while others have failed to find evidence for this prediction. Such failures have been attributed by advocates of the theory to moderators and mediators that have been overlooked but nonetheless significantly influence the existence of these affective associations (e.g., Boldero & Francis, 1999; Higgins, 1999). In the current experiment, a significant association did emerge: the ideal-actual discrepancy scores predicted DASS depression subscale scores, however this relationship was negative, which squarely opposes expectation. The ought-actual discrepancy scores were not specifically associated with any indicators of negative affect or emotional distress. When both types of self-discrepancies were merged to form an overall discrepancy score, it was found to be also predictive of the DASS depression subscale scores, but again the beta coefficient indicated a negative relationship. It is unclear why the relationships are opposite to what would be predicted by SDT. Several additional regression analyses were

significant but these may have emerged by chance due to fact that many regression analyses were run.

More central to the current experiment is the question of age-related differences. There were no significant age differences in the discrepancy scores. There were however differences in the ratings made by participants. Older adults rated the future self-attributes lower than younger adults did, but they made lower current self-attributes ratings as well. This explains the lack of group difference in the discrepancy scores. This finding accords with what Heidrich & Ward (1992) found in their study of older women with and without cancer, despite the fact that they employed a different measure of self-discrepancy. Their explanation was that in order to maintain well-being and psychological equanimity in the face of both illness-related loss and a foreshortened future, the older women with cancer had to lower their future expectations to maintain the magnitude of discrepancy between their actual and hoped-for selves. Perhaps a similar self-preserving mechanism explains the findings in the current experiment. It should be noted that some other studies (which were reviewed in the introduction) have found that the magnitude of discrepancies decreases with age. However, none of the studies have employed this particular task, and in general, the evidence is mixed.

Turning to the qualitative analysis, while acknowledging that the methods and results are exploratory and preliminary, they nonetheless yielded interesting findings. The self-attributes covered a wide variety of themes and domains, and this variety was seen in both the older and younger adults. The attributes were categorized according to a novel but intuitive coding scheme guided by previous research on possible selves (e.g., Smith & Frazier, 2002). Eight domains were established. Both age groups reported the greatest number of attributes representative of interpersonal conscientiousness, and although older adults generated proportionally more from

this category, this difference was not significant. The next most frequent attributes for younger adults came from the achievement process category, followed by the achievement product and dispositional categories. Meanwhile, the older adults reported attributes relating to duties and obligations, followed by those associated with mental or cognitive characteristics. These findings are somewhat intuitive, but also in agreement with empirical findings and theoretical expectations. SEST would predict that older adults become even more preoccupied with interpersonal goals in order to maintain positive emotion regulation. Further, RFT and more general lifespan accounts such as the SOC model predict that as a whole, younger adults should be concerned with gains, and the fact that the next most important categories for this group indeed related to achievement supports this. Because this particular task did not ask about feared-selves, it is impossible to comment on the tendency to become preoccupied with maintenance or loss *per se* as a function of aging. However, the older adults did show a preponderance for attributes relating to duties and obligations (or shoulds), which could be taken as support for a preoccupation with more prevention-related issues. Frazier and colleagues' work on the possible selves of older adults reported a growing concern with health-, social-, and cognitive-related domains. The current results are in agreement with this: the older adults generated significantly more attributes from the physical domain than did the younger adults. Although there was no significant age difference in the mental/cognitive domain, the older adults tended to produce proportionally more attributes than the younger adults.

Overall then, the results from the SST indicate that self-discrepancies do not change with age despite the fact that the ratings of both future and actual selves decline. This can be interpreted as an example of adaptive change in self-evaluation and personal-goal setting in order to maintain a constant level of difference between future and current selves. What is more, while

self-discrepancies are unchanged, the content of these self-attributes remains diverse and shifts in focus with age. The results suggest that attributes relating to positive interpersonal interactions remains important for all ages, with a trend for this domain to become even more important with age. Older adults generated significantly more attributes characteristic of duties and obligations while younger adults produce significantly more from the achievement product domain, which agrees with both RFT and lifespan models of development. Finally, older adults become more concerned with attributes relating to physical health and function as compared with younger adults, which supports the literature from other qualitative studies about goals and possible selves across the lifespan.

Experiment 2

The main purpose in this second experiment was to obtain a better understanding of how regulatory focus influences behaviour by measuring which types and domains of cognitive function are affected. Two groups underwent a regulatory focus induction procedure that has been described in several earlier studies in order to manipulate momentary regulatory focus in younger adults and subsequently explore the effects on cognition. Overall, the induction produced some cognitive effects but generally speaking, they were not as encompassing as expected, nor in the directions in which they were predicted.

With respect to the emotional memory task, there was an overall effect of emotion salience. The omnibus test showed that both the positive and negative words were remembered better than the neutral words, but there was no significant difference between them. There was also no significant effect of group, which diverges from the study by Touryan et al. (2007). This study found that overall memory performance was significantly better for the prevention compared with the promotion group (there was no control group). However, although they

found significant dissociations in brain activity for the promotion and prevention groups depending on the valence of the stimuli, they did not observe a significant Group X Valence interaction at the level of the behavioural data. There was also no main effect of valence in the behavioural data, which they speculated is because the deep encoding task required more processing for the neutral words, which in turn boosted the memorability of these stimuli to the level of the emotional words. This finding also differs from the current study for here, an emotional salience effect was found. Again, because the encoding procedures were different between the studies, it makes it difficult to make a clear comparison between results.

In the current study, there was also a significant Group X Valence interaction, which was explained by a tendency for better recall of positive words by the prevention group compared with the promotion group. This finding is contrary to the expectations derived from regulatory fit, as well as from the previous studies described in the introduction. However, this finding did not quite reach significance and thus may not be reliable.

More significantly, there was a group difference for the memory of the neutral words whereby the promotion group had superior memory performance compared with both the prevention and control groups. While both the prevention and control groups demonstrated a traditional emotion salience effect (and a trend towards a negativity effect), the promotion group was not affected by valence. In other words, the promotion induction served to dampen the usual effect of emotion on memory by enhancing the retention of neutral words. Although speculative, the promotion induction could have strengthened the use of controlled processing, which bolters memory for non-arousing, and especially neutral words. Perhaps the nature of the emotional stimuli (i.e., all concerning cognitive or mental subject matter) was particularly salient for these individuals, especially given the context (i.e., academic setting; psychology experiment).

Ultimately, the reason why this effect emerged remains elusive. It is also unclear why the prevention induction did not lead to any differences in performance as compared with the control group.

In the perception task, the inductions did not produce as pronounced an effect as hypothesized. There was a significant Group X Degradation interaction on accuracy, which was driven by a trend towards lower accuracy in the promotion group compared with the control group. It was predicted that the ideal condition would prioritize speed over accuracy relative to the ought condition, not necessarily the control condition. However, there were no group differences with respect to reaction time for any degradation level. The diffusion modelling analysis showed that while there were no group differences concerning perceptual efficiency, the promotion group had lower boundary separation values compared with the control group (at the lowest degradation level only), which reflects the accuracy findings described earlier. In other words, those in the promotion group adopted less conservative decision criteria. Finally, there were no significant group differences in non-decision time. Thus, the predictions were unsupported for the most part, although the behaviour of the promotion group compared with the control group (for the lowest degradation level at least) somewhat reflects the expectation that this group would prioritize speed over accuracy. However, any substantial interpretation beyond this is unwarranted given that this only emerged for stimuli at only one of the degradation levels and that no group differences were apparent for reaction time. Taken together, the situational induction of regulatory focus did not have clearly discernible effects on this particular task of low-level cognition.

In sum, it appears that the induction did not produce strong effects in either a higher-level cognitive task of emotional memory, nor in a more basic visual perception task. The effects that

did emerge resulted from the promotion induction: memory for neutral stimuli was improved, thereby removing the emotional salience effect. This induction also led to differences in accuracy and boundary separation relative to the control group, whereby the promotion group became less conservative in their decision making. However, this effect only appeared at the lowest degradation level. Overall, it is unclear if the induction failed to modulate regulatory focus or if these particular tasks are generally not modulated by these regulatory focus inductions.

Limitations

There are several limitations that constrain the interpretation of the results. Regarding Experiment 1, there are methodological as well as participant issues. In retrospect, it would have been judicious to pilot the SST in older adults prior to conducting the experiment. It was primarily the older participants who presented difficulties with the task, likely due to less familiarity with computers. More generally though, a reaction time task that is comprised of so few trials, combined with the significant interrelatedness between the theoretical constructs, raises concerns about the instrument's ability to validly characterize individuals' chronic regulatory focus. That said, the instrument appeared to provide useful information with respect to overall self-discrepancy and self-goal generation. There are caveats to the interpretation of the qualitative data however: the coding system is exploratory and preliminary and thus could be refined further. It is possible that this system neglected other important domains or other plausible ways of capturing the data. Furthermore, the domains that emerged are undeniably influenced by the epistemological standpoint of the coder (LL). It is acknowledged that this coding system is shaped by her cultural and intellectual biases, which will contribute to the limitations inherent to such an analysis. Further tests of inter-rater reliability should be

conducted to refine it. Nonetheless, this coding system represents an important stepping stone, especially given that the content of this task has not been qualitatively analyzed to date.

There are also important differences between the participant samples: the older adults were generally Caucasian, well-educated, and particularly keen to participate in the research for its own sake. The younger adults represented a more culturally diverse sample, were less educated (as a function of their age), and were likely motivated to participate by different factors. As such, it is possible that in addition to age differences, there were also other important factors that may have influenced the results.

Regarding Experiment 2, there are also methodological limitations to be acknowledged. Although the use of the regulatory focus induction has been documented several times in the literature, there exists no standard means to verify if the manipulation in fact succeeded. It is possible that the reason the results did not support the hypotheses is that the induction was ineffective or inconsistent between participants. One way to circumvent this or at least attempt to verify this possibility is through a qualitative analysis of the essays with an eye towards indicators that would separate a promotion or prevention focus. On the one hand, it could be argued that the content of the essays should not matter since the crucial thing is that the participants subjectively experience a change in their motivational approach. An analysis of the content may also not be able to clearly identify which regulatory focus has been primed anyway, since both ideal and ought-related content can appear similar, if not identical. Theoretically, what matters is how the individual subjectively feels or conceptualizes the content, which may not come through in the essays. On the other hand however, there may be as yet unknown but valuable information contained in the essays that could inform the validity of the induction; such an analysis has not been documented in the literature. Linguistic analyses have been carried out

on other types of written information however (Semin *et al.*, 2005), which suggest that it may be a worthwhile pursuit. Another option could be to utilize the SDT from Experiment 1 as the manipulation check for Experiment 2[10]. If regulatory focus is malleable, it would be expected that the response latencies in the SDT should be relatively shorter for the type of focus that was primed by the essay. Although using the SDT in this fashion has not been validated, it could be a worthwhile avenue to explore in the attempt to increase the validity of the regulatory focus constructs and measures. Returning to the current findings, without a manipulation check it is difficult to separate if the overall lack of support for the hypotheses means that the manipulation did not 'work' or that the effects of regulatory focus do not extend as far as these particular cognitive domains.

Future Directions

The results of this research could be built upon in several ways. As mentioned earlier, a qualitative analysis of the induction essays would be a valuable endeavour: First, to possibly provide a manipulation check of the induction, and second, to provide more insights into what types of goals are generated by younger adults in response to the essays questions. Depending on the results and the reliability of the analysis, this endeavour could even be extended to a sample of older adults. The essays could provide richer information about goals and aging than the SST, which is restricted to one-word responses.

Another direction could be the development of a valid and reliable measure of chronic regulatory focus in older adults. There are questionnaire self-report measures in existence but as alluded to in the introduction, they were not selected for use in this current research since some of the items would likely be inapplicable to older adults or at least would have a different

[10] Assuming that the concerns about the validity of this task were addressed.

meaning for them as compared with younger adults. Nevertheless, perhaps the modification of one of these measures or the outright development of a new instrument that circumvents the limitations of the SST would be worthwhile.

More broadly, continuing research that addresses how motivation shapes behaviour and cognition remains an important undertaking. Other cognitive faculties, such as risky decision-making in different domains (gains or losses), could be explored with respect to aging and regulatory focus. Incorporating motivational factors such as goals and other motivational constructs into cognitive aging research is in line with recent calls for a broader, more contextual perspective in cognitive research (Hess, 2005). Such research is important, especially with respect to the growing number of older adults who want to optimize their cognitive function to enhance well-being.

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Tables

Table 1: *Response Latencies for the SST*

Response latency (seconds)	Group	
	Young (N=26)	Older (N=22)
Time for typing attribute	14.17 (14.21)	25.21 (15.73)
Range	188.19	90.83
Time to make first rating	4.55 (3.22)	8.35 (6.70)
Range	20.55	55.16
Time to make second rating	2.80 (2.37)	5.58 (4.10)
Range	12.15	25.61

Table 2: *Demographic Data – Experiment 1*

Variable		Group			
		Young (N=26)	Older (N=22)	Statistical Test (t or χ^2)	p value
	Age	19.46 (2.53)	73.41 (5.47)	t(28.52) = -42.53	< .001
	Education	12.77 (1.68)	15.77 (2.52)	t(35.51) = -4.76	< .001
	MMSE	-	28.77 (0.87)	-	-
Sex				$\chi^2(1) = .088$	ns
	Female	21	17		
	Male	5	5		
First Language				$\chi^2(1) = 2.37$	ns
	English	16	18		
	Other	10	4		

Mean (Standard Deviation)

Table 3: *Baseline Measures – Experiment 1*

Variable		Group			
		Young (N=26)	Older (N=22)	Statistical Test (t)	p value
	Digit Symbol Coding	77.54 (16.80)	60.59 (11.50)	t(46) = 4.00	< .001
	Shipley Vocabulary	25.88 (3.65)	36.59 (2.11)	t(41.02) = -12.67	< .001
DASS	Total	16.73 (8.97)	6.23 (4.15)	t(36.48) = 5.33	< .001
	Depression	4.73 (4.11)	1.50 (2.54)	t(42.37) = 3.33	= .002
	Anxiety	4.54 (3.35)	1.59 (1.44)	t(35.07) = 4.07	< .001
	Stress	7.15 (4.27)	3.64 (3.33)	t(45.74) = 3.20	= .002

Mean (Standard Deviation)

Table 4: *PANAS – Experiment 1*

Variable		Group	
		Young (N=26)	Older (N=22)
PANAS Positive			
	Pre	28.77 (7.11)	35.68 (5.41)
	Post	27.69 (6.82)	35.42 (6.01)
PANAS Negative			
	Pre	14.15 (4.54)	10.59 (0.91)
	Post	12.81 (3.75)	11.32 (2.46)

Table 5: *Emotional Memory Task – Experiment 1*

Variable	Group			
	Young (N=26)	Older (N=22)	Statistical Test (t)	p value
Total Recall	8.31 (2.49)	5.05 (2.75)	t(46) = 4.31	<.001
Number of Intrusions	.73 (.72)	1.41 (1.47)	t(29.48) = -1.97	.058
Proportion Positive	.33 (.13)	.29 (.23)		
Proportion Negative	.43 (.13)	.47 (.20)		
Proportion Neutral	.24 (.11)	.24 (.27)		

Table 6: *Self-Strength Task*

Variable		Group	
		Young (N=26)	Older (N=22)
Mean Ratings			
	Future	13.77 (1.32)	12.57 (1.66)
	Actual	10.27 (1.09)	8.93 (2.07)
Overall Discrepancy		6.38 (2.90)	6.18 (4.04)

Table 7: *Frequencies and Percentages of Self-Attributes across Coding Domains*

Coding Domain	Group		Coding Domain	Group	
	Young (N=22)	Older (N=25)		Young (N=22)	Older (N=25)
	Number of Attributes			Percentage	
Achievement Product	29	9	Achievement Product	14.5	5.2
Achievement Process	30	14	Achievement Process	15.0	8.1
Mind/Cognitive	19	20	Mind/Cognitive	9.5	11.6
Dispositional	29	15	Dispositional	14.5	8.7
Interpersonal Conscientiousness	55	57	Interpersonal Conscientiousness	27.5	33.1
Interpersonal Positive Regard	13	7	Interpersonal Positive Regard	6.5	4.1
Duties/Obligations	21	37	Duties/Obligations	10.5	21.5
Physical	4	13	Physical	2.0	7.6
Total number of attributes	200	172			

Table 8: *Age Differences between Life Domains*

Domain	Included	B	Std. Error	95% Wald Confidence Interval	Wald Chi-Square	p statistic
Achievement Product	Age	-1.04	.38	[-1.79, -.29]	$\chi^2(1) = 7.46$	<.01
Achievement Process	Age	-.63	.32	[-1.27, 7.38E-5]	$\chi^2(1) = 3.84$	.05
Mind/Cognitive	Age	.18	.32	[-.45, .81]	$\chi^2(1) = .31$	.58
Dispositional	Age	-.53	.32	[-1.16, .09]	$\chi^2(1) = 2.79$	.095
Interpersonal Conscientiousness	Age	.16	.19	[-.21, .53]	$\chi^2(1) = 6.70$	.387
Interpersonal Positive Regard	Age	-.49	.47	[-1.41, .43]	$\chi^2(1) = 1.10$	.295
Duties/Obligations	Age	.69	.27	[.16, 1.23]	$\chi^2(1) = 6.46$	.011
Physical	Age	1.31	.57	[.19, 2.43]	$\chi^2(1) = 5.22$	.022

Table 9: *Demographic Data – Experiment 2*

Variable		Group				
		Ideal (N=26)	Ought (N=28)	Control (N=30)	Statistical Test (F or χ^2)	p value
	Education	12.85 (1.57)	12.68 (1.16)	12.87 (1.68)	F(2,81)=.136	.873
Sex					.770	.681
	Female	21	24	23		
	Male	5	4	7		
First Language					.827	.661
	English	17	15	17		
	Other	9	13	13		

Mean (Standard Deviation)

Table 10: *Baseline Measures – Experiment 2*

Variable		Group			Statistical Test	p value
		Ideal (N=26)	Ought (N=28)	Control (N=30)		
	Digit Symbol Coding	85.08 (12.73)	81.04 (13.72)	76.80 (16.37)	F (2, 81) = 2.292	.108
	Shipley Vocabulary	26.96 (4.24)	26.21 (3.86)	25.77 (3.94)	F (2, 81) = .626	.537
DASS	Total	16.12 (11.28)	15.36 (11.11)	17.10 (10.01)	F (2, 81) = .191	.827
	Depression	4.85 (3.44)	4.18 (4.64)	4.80 (4.71)	F (2, 81) = .207	.814
	Anxiety	6.85 (4.89)	3.96 (3.81)	4.60 (3.41)	F (2, 81) = 3.748	.028
	Stress	8.15 (4.45)	6.25 (4.17)	7.20 (4.41)	F (2, 81) = 1.295	.280

Table 11: *PANAS – Experiment 2*

Variable		Group		
		Ideal (N=26)	Ought (N=28)	Control (N=30)
PANAS Positive				
	Time1	26.19 (5.93)	26.86 (7.64)	29.77 (7.18)
	Time2	23.46 (7.16)	22.36 (7.14)	28.53 (6.90)
PANAS Negative				
	Time 1	12.04 (1.97)	13.82 (3.80)	14.03 (4.24)
	Time 2	11.35 (1.41)	13.04 (3.38)	12.93 (3.59)

Table 12: *Emotional Memory Task – Experiment 2*

Variable	Group				
	Ideal (N=26)	Ought (N=28)	Control (N=30)	Statistical Test (F)	p value
Total Recall	7.88 (2.79)	7.54 (2.29)	8.23 (2.80)	F (2, 81) = .507	.604
Number of Insertions	.69 (.97)	.93 (1.46)	.67 (.71)	F (2, 81) = .496	.611
Proportion Positive	.30 (.14)	.39 (.16)	.34 (.13)		
Proportion Negative	.36 (.10)	.36 (.13)	.42 (.14)		
Proportion Neutral	.33 (.15)	.24 (.14)	.24 (.10)		

Figures

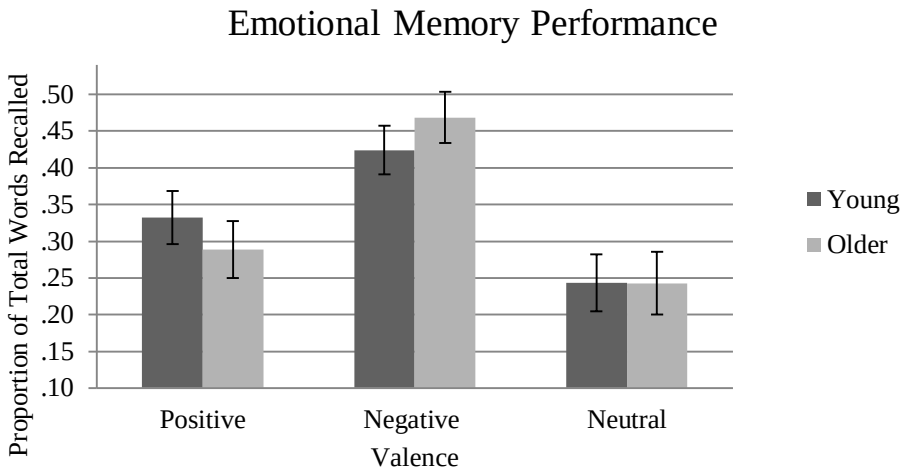

Figure 1: Emotion Memory Performance between Age Groups

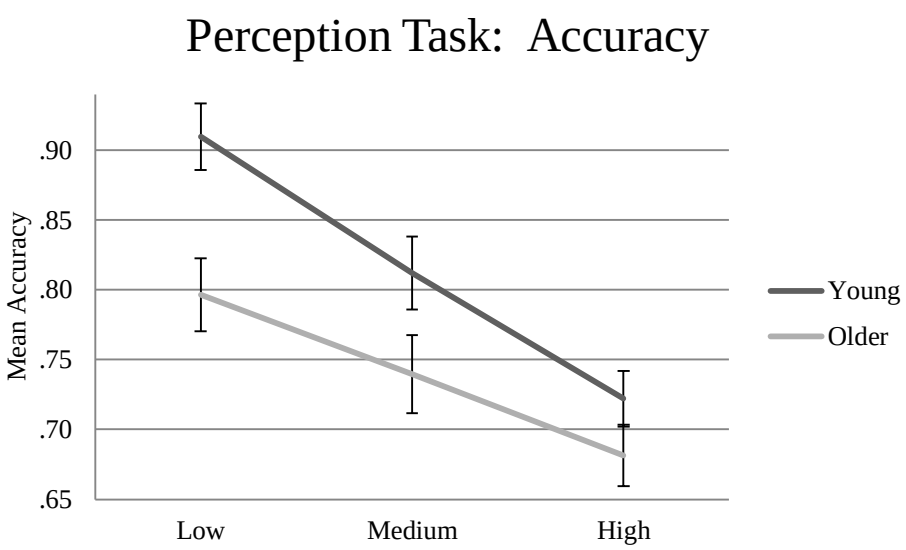

Figure 2: Average Accuracy Performance across Degradation Levels

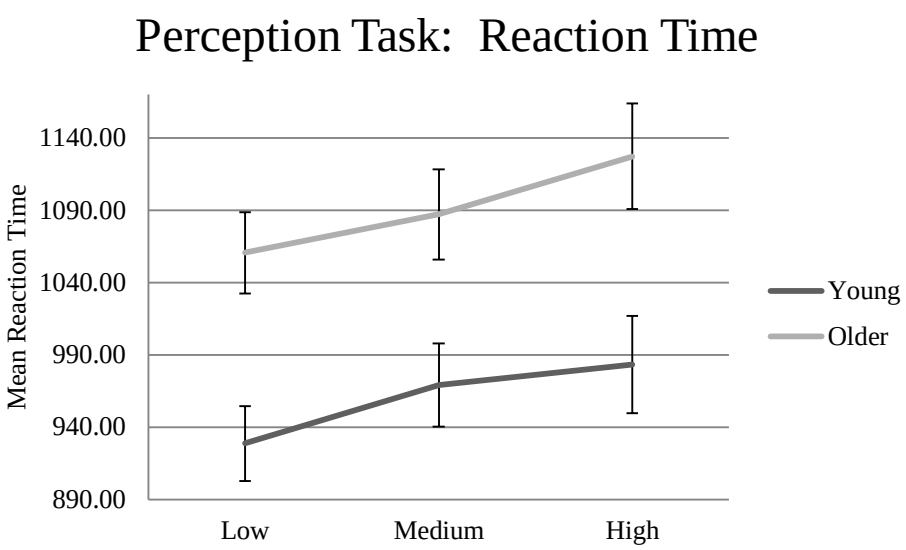

Figure 3: Average Reaction Times across Degradation Levels

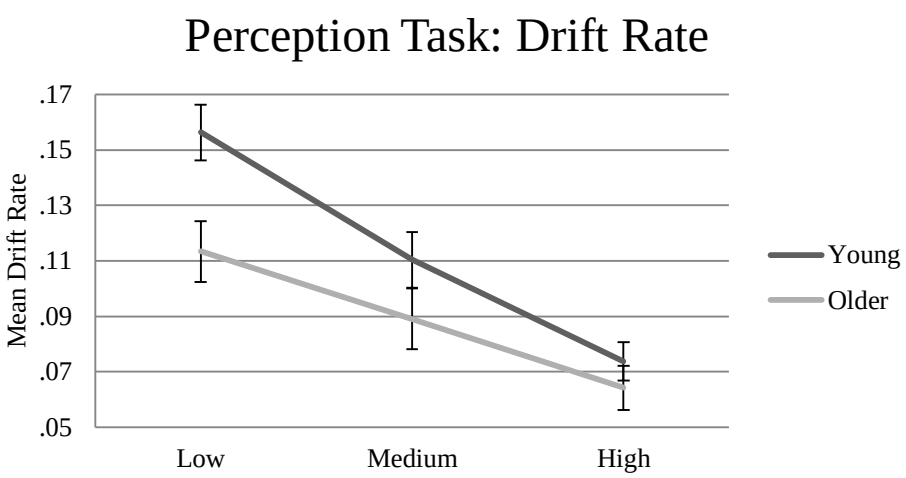

Figure 4: Average Drift Rate across Degradation Levels

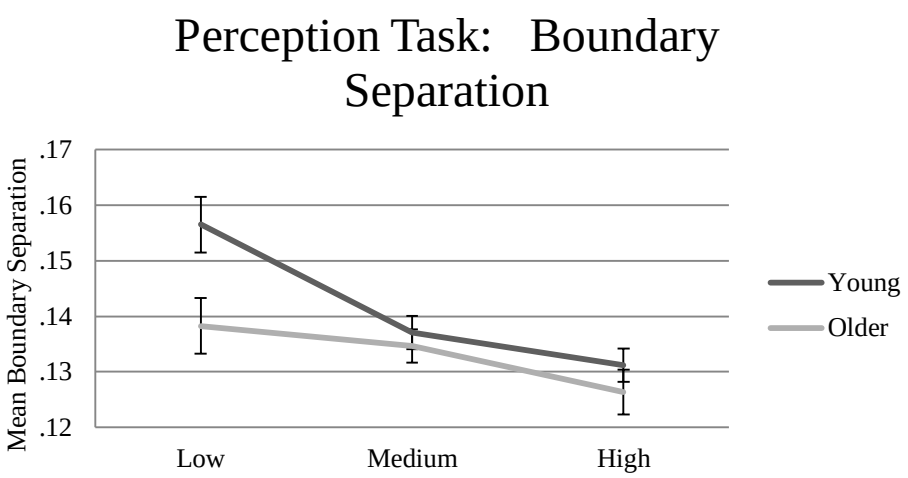

Figure 5: Average Boundary Separation across Degradation Levels

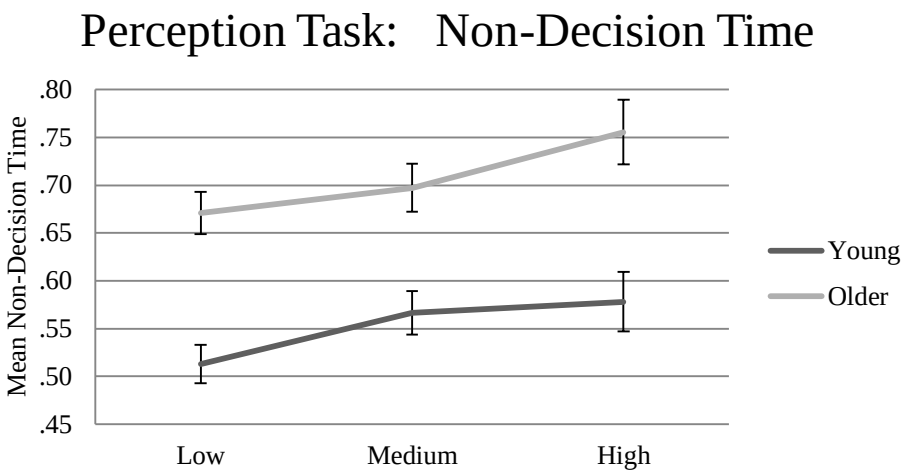

Figure 6: Average Non-Decision Time across Degradation Levels

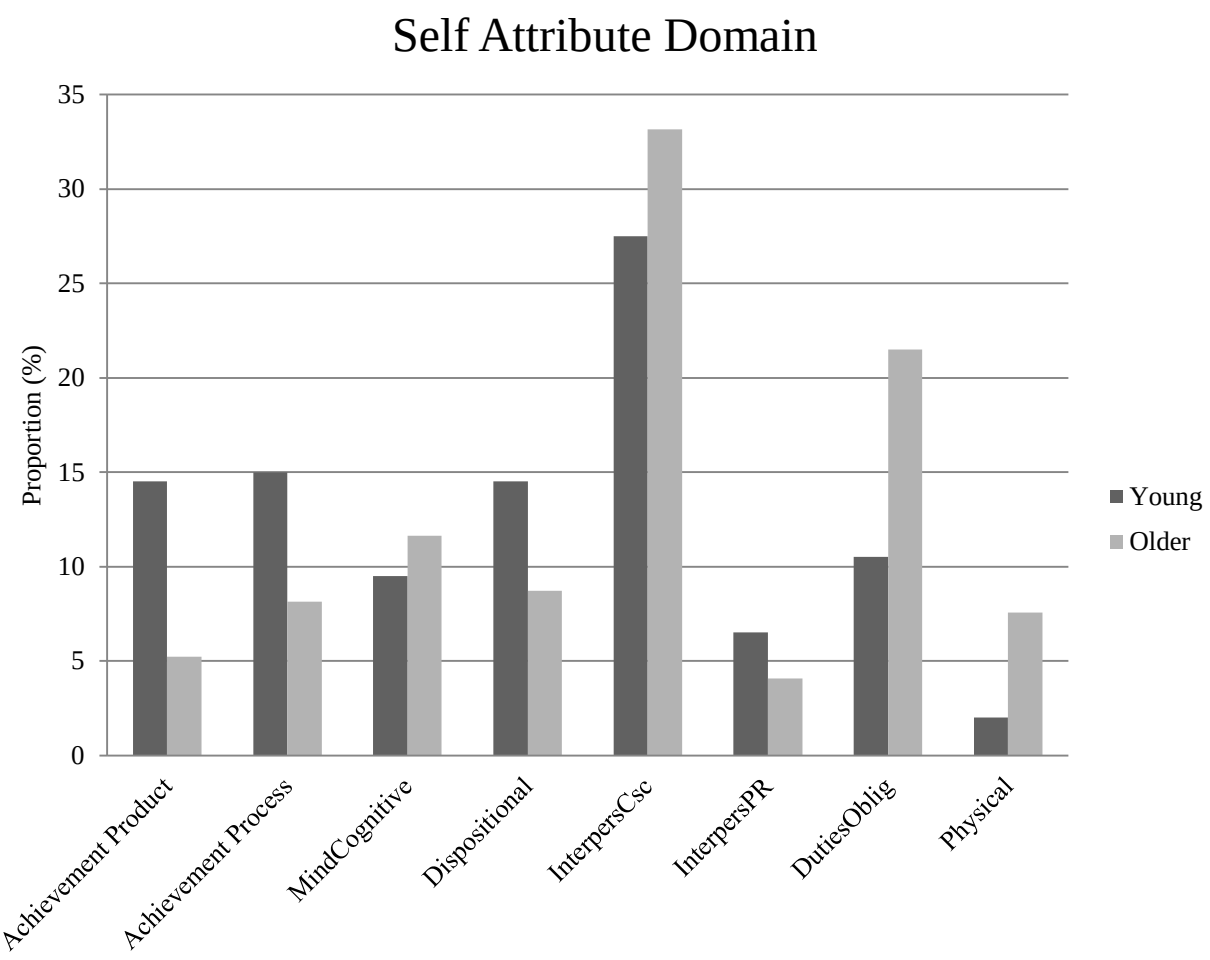

Figure 7: Domains of Self Attributes Between Age Groups

Procedure	
Ideal and Ought Conditions	Control Condition
1. Consent	1. Consent
2. Baseline cognitive measures	2. Baseline cognitive measures
3. PANAS 1	3. PANAS 1
4. Essay induction	4. Memory Task
5. Memory Task	5. Perception Task
6. Rereading of essay	6. Self-Strength Task
7. Perception Task	7. PANAS 2
8. PANAS 2	8. Screening & Debriefing
9. Screening & Debriefing	

Figure 8: Procedural Overview of Experiment 2

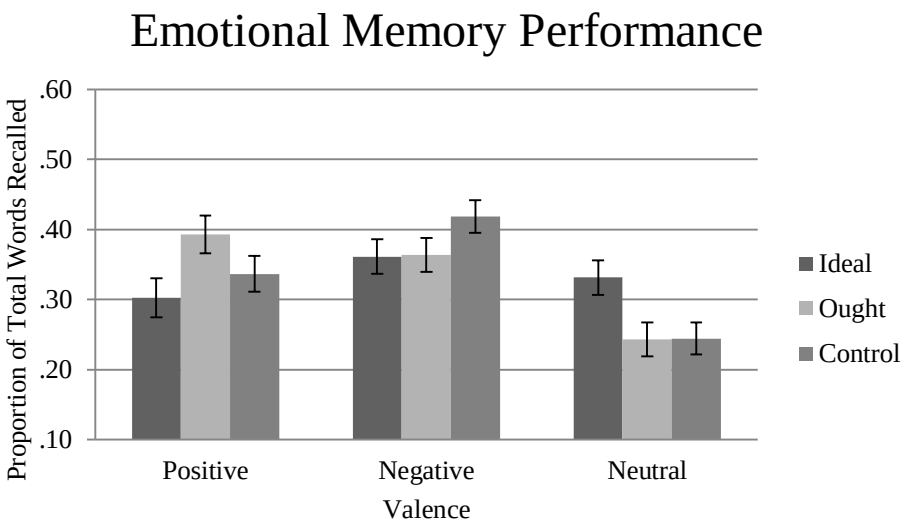

Figure 9: Emotional Memory Performance

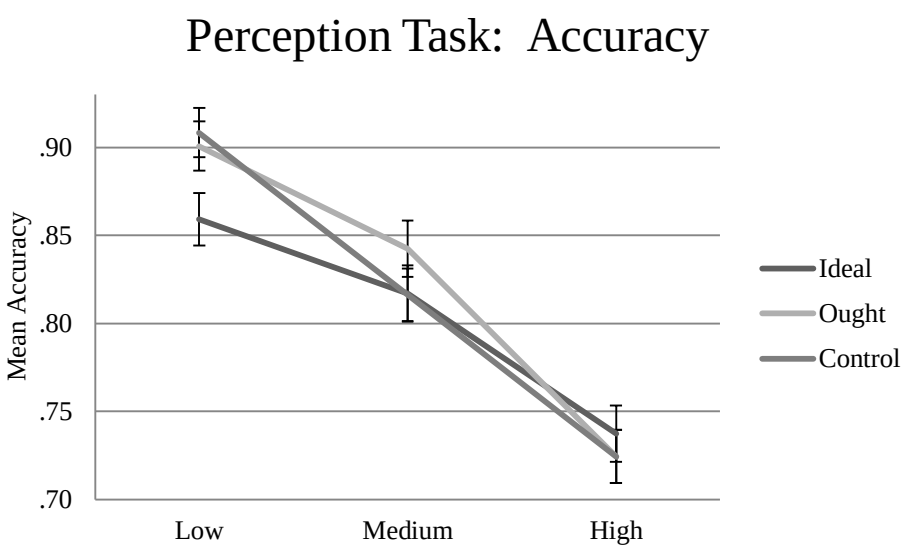

Figure 10: Average Accuracy across Degradation Levels

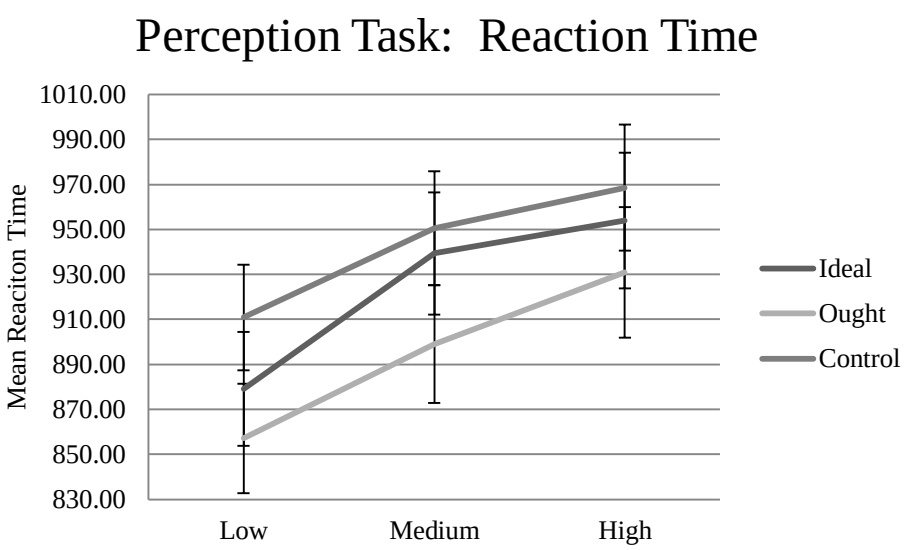

Figure 11: Average Reaction Times across Degradation Levels

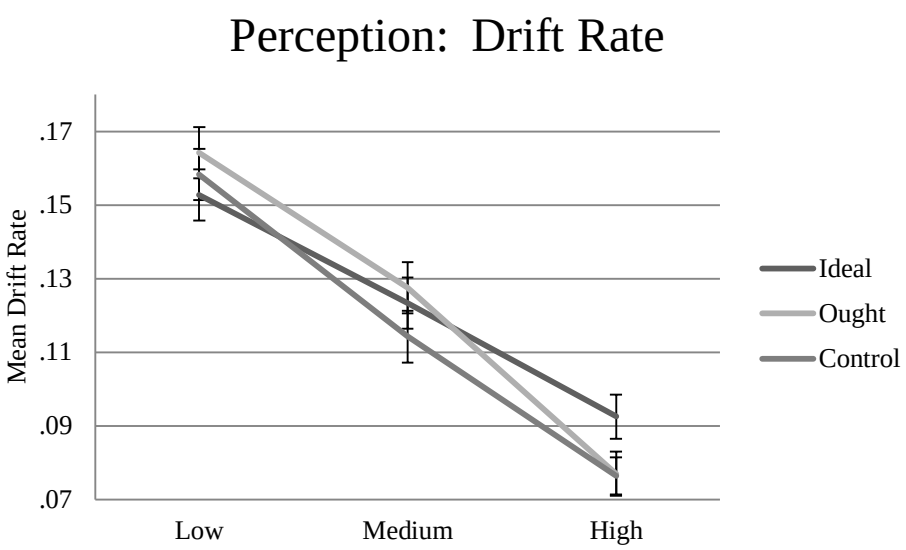

Figure 12: Average Drift Rate across Degradation Levels

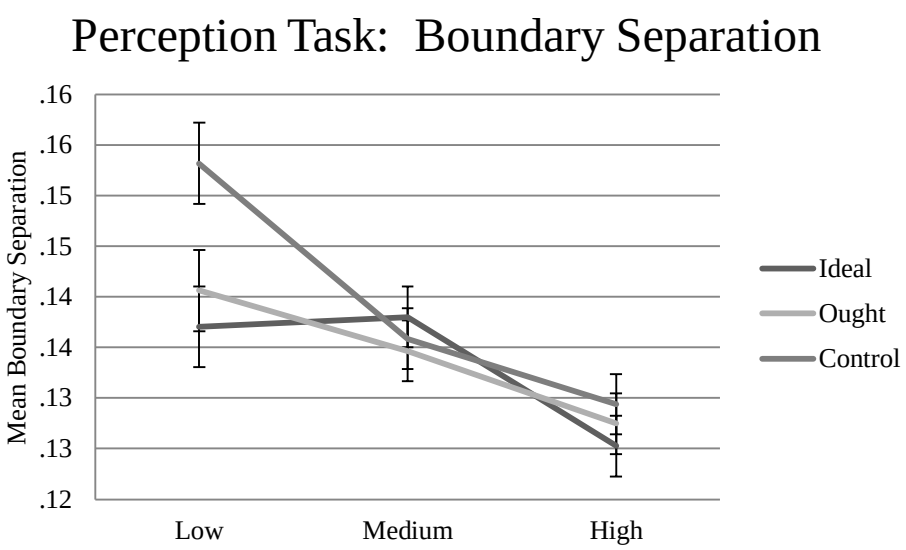

Figure 13: Average Boundary Separation across Degradation Levels

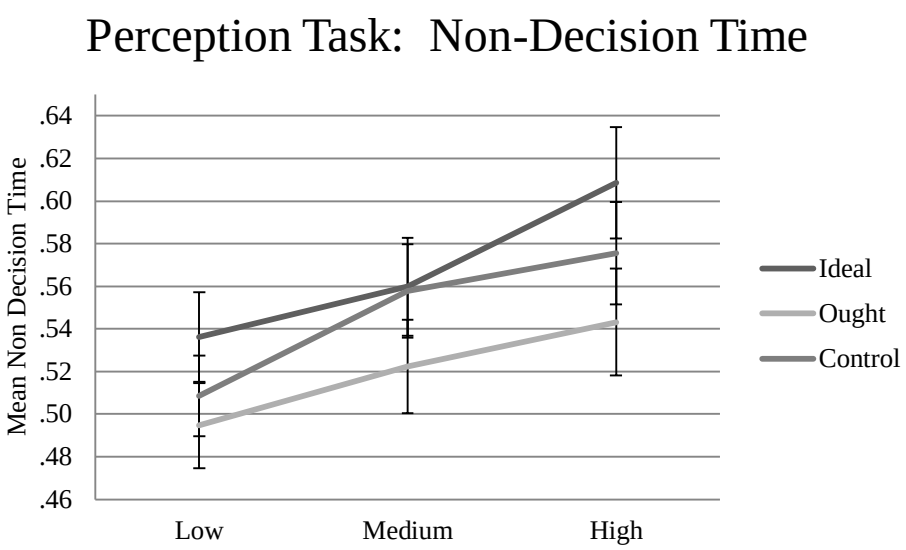

Figure 14: Average Non-Decision Time across Degradation Levels

Appendix: Memory Stimuli

Positive Words	Negative Words	Neutral Words**
SECURE	WASTE	HINT
SLEEP	FEVER	GRASP
SOOTHE	GRIEF	INFORM
BLESS	GLOOM	MENTAL
BREEZE	BORED	OPINION
COZY	OBESITY	REASON
USEFUL	GERMS	DATA
REWARD	SLUM	DECIDE
SUNSET	LONELY	LUCID
ANGEL	COWARD	MUSE
Average valence = 7.34 (0.25)*	Average valence = 2.51 (0.45)	Valence between 3.1-5.9
Average arousal = 4.03 (0.72)	Average arousal = 4.16 (0.58)	Arousal 4.9 or below

*Valence and arousal ratings are taken from the ANEW (Bradley & Lang, 1999), as cited in Kensinger (2008)

** words related to "think" or "mind" (Kensinger, 2008)

Appendix: Visual Perception Stimuli