Nurturing the Temporally Extended Self: Mental Imagery as an Intervention to Increase
Future Self-Continuity and Reduce Academic Procrastination

by

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Abstract

In my thesis research, I examined how mental imagery practice can increase future self-continuity to reduce academic procrastination. A sample of 193 undergraduate students was randomly assigned to a present-focused meditation or to a future-self focused mental imagery condition. I asked participants in both conditions to listen to an audio recording twice per week for four consecutive weeks and to complete a pre-intervention, half-point, and post-intervention questionnaire. I hypothesized that participants in the mental imagery condition would feel more connected to future self at the end of the semester because of increases in vividness of future self and empathy for future self. I also hypothesized that feeling more connected to future self at the end of the semester would lead participants in the mental imagery condition to report less procrastination. At the four-week mark, results revealed that both future self-continuity and empathic perspective taking were significantly higher for the mental imagery condition than the meditation condition. Furthermore, future self-continuity was predictive of decreases in procrastination. Latent growth model analyses revealed that all variables of interest systematically changed across time. While vividness of future self moderated change in future self-continuity across time, affective empathy for future self mediated the relation between vividness of future self and future self-continuity. Lastly, only empathic perspective taking was a significant moderator of change in procrastination across time. I discuss why participants in the mental imagery and the meditation conditions experienced very similar increases in future self-continuity, vividness, and affective empathy across time, and similar decreases in procrastination. I also explain how results regarding the influence of empathic perspective taking on future

self-continuity and procrastination are in line with theoretical and empirical evidence from the empathy literature. Finally, I summarize the limitations of the present research design and suggest routes for future research.

Keywords: Procrastination, Future Self-Continuity, Mental Imagery, Empathy

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Nurturing the Temporally Extended Self: Mental imagery as an Intervention to Increase
Future Self-Continuity and Reduce Procrastination

Eve-Marie C. Blouin-Hudon

“People always say 'be true to yourself' but that's misleading, because there are two selves. There's your short term self, and there's your long term self. And if you're only true to your short term self, your long term self slowly decays.” – anonymous

As human beings, we not only have the chance of living increasingly long lives, but we also have the imaginative capacity of remembering the past and anticipating how our lives will unfold. Indeed, William James (1985, originally published in 1892) has proposed that this ability to connect our past, present, and future selves into one continuous narrative derives from our “consciousness of personal sameness” through subjective time. For example, a woman remembering herself as a child doing cartwheels may not be as nimble as she used to be, but can nonetheless agree that the little girl was herself. Similarly, a university student picturing herself in a crowded exam room, peacefully reading under a tree, or even preparing to retire can agree that the image of this future self represents her and not someone else.

Unfortunately, anticipating who one might be and feeling connected and similar to one’s future self are two different things (Bartels & Rips 2010; Bartels & Urminsky 2011). For most people, it might be more appropriate to conceptualize past, present, and future selves as an infinite number of overlapping selves connected by temporal proximity (Parfit, 1971, 1987). Under this definition, the connection between each

temporal self is contingent on the time that has passed –or the time that has yet to pass – between each self. Consequently, the university student might not perceive any similarity to her retired, or even next year's, self and may feel as connected to her future self as she would be to a stranger (Hershfield, Cohen, & Thompson, 2011).

Nonetheless, finding a sense of self that is connected and continuous over subjective time is important as it allows one to maintain a steady sense of *identity* (Bird & Reese, 2008). In fact, self-continuity has been proposed to complement personal narratives by regulating experiences throughout the lifetime and can be of great assistance to decision-making (Sani, 2008; Blatt & Quinlan, 1967). As a consequence, discontinuities within the temporal sense of self can seriously disrupt the organization of incoming information and result in the maladaptive planning of everyday behaviours (Blatt & Quinlan, 1967; Damasio, 2010; Greenwalk, 1980), lead to unethical choices (Hershfield et al., 2011), and decrease overall well-being (Singer & Bluck, 2001).

Procrastination is a good example of a common behaviour that is detrimental to well-being (Sirois & Pychyl, 2013). Indeed, procrastination is negatively associated with a future time perspective (Ferrari & Diaz-Morales, 2007) such that consequences for future self are ignored while present states are favoured in order to 'feel good now' (Jackson, Fritch, Nagasaka, & Pope, 2003, Tice & Bratslavsky, 2000; Tice, Bratslavsky, & Baumeister, 2001).

Due to the present-focused nature of procrastination, researchers have come to agree that such self-defeating delay belongs to a larger class of self-regulatory problems and that it might be best considered an avoidant coping strategy (Sirois & Pychyl, 2013). Hence, procrastinators delay situations that are perceived as negative, unpleasant, or

challenging because such anticipations increase negative emotions¹ in the present (Blunt & Pychyl, 2000; Pychyl, Lee, Thibodeau, & Blunt, 2000; Tice & Bratslavsky, 2000; Tice, Bratslavsky, & Baumeister, 2001).

What makes this failure to project oneself into the future particularly problematic is that by continuously leaving more work for later, procrastination is likely to cause increases in stress and negatively influence subsequent mental health (Flett, Blankstein, & Martin, 1995; Sirois, Melia-Gordon, & Pychyl, 2003; Tice & Baumeister, 1997). As such, a person's inability to sense a connection to future self appears to be somewhat responsible for promoting additional procrastination and for perpetuating this cycle of self-defeating behaviour (Sirois & Pychyl, 2013; Ferrari & Diaz-Morales, 2007; Jackson, Fritch, Nagasaka, & Pope, 2003).

Procrastination understood from the perspective of the primacy of present self over future self does suggest some routes to intervention. For example, one possible method would be to decrease the gap or increase the perceived continuity between

¹ When I use the term "emotion" throughout this text, I will be referring to the concept of emotion found in the literature. Indeed, these labels distinguish concepts used to describe unique but highly interconnected processes. Firstly, affect represents an umbrella concept comprised of moods and emotions. In other words, affect represents the *feeling tone* associated with the sense of pleasantness and unpleasantness permeating mental experience. On the other hand, moods typically differ from emotions in length and intensity. In fact, moods are long lasting and fairly consistent states that build gradually over time (Parkinson et al., 1996). Of particular relevance to procrastination, emotions typically arise as a response to *specific* purposes and differ from other motivational impulses such as hunger, sex and pain because of the *flexibility* and *variability* of their objective and target. As such, emotions are experienced with varying arousal and their onset is brief and usually caused by an identifiable incident or event (Lang, 1979). However, the particularly efficient priming properties of emotions often lead to non-conscious and often habitual responses (Zemack-Rugar, Bettman, & Fitzsimons, 2007).

present and future selves. Certainly, work by Ersner-Hershfield and his colleagues (2009) suggests that we make better decisions for future self in terms of retirement savings when we experience more future self-continuity². To facilitate this “time travel” to the future self, Hershfield used digitally aged photos of research participants. Those who viewed digitally aged selves compared to images of present self made better choices in relation to future self by allocating greater amounts of money to retirement savings. Although actual images of self in the present and future are certainly compelling, an alternative to this very concrete representation of future self in a picture may be possible by harnessing our unique ability to imagine; in other words, a mental representation as opposed to a photographic representation of future self. Accordingly, an important process of the imagination, mental imagery, could be used as a psychological tool to bridge the gap between present and future self and, consequently, reduce procrastination.

Broadly speaking, the imagination represents creative, aesthetic, and expressive thoughts and images such as writing a poem or painting a portrait from memory (Byrne, 2005). It is precisely the ability to be conscious of objects that are not directly perceived through the senses that most strongly characterizes the concept of imagination in psychology (Byrne, 2005; Angell, 1906). This conceptualization also defines a central function of imagination: mental imagery. Mental imagery represents the ability to vividly

² Since this masters thesis is focused on future self, it may seem more appropriate to refer to this construct as “future-self continuity”. However, this construct is broadly referred to as “self-continuity” in the literature to define the self as extending from the past to the future. As such, “future self-continuity” is a more specific label for “self-continuity” to define the self as extending from the present to the future. To be consistent with the existing literature, I will refer to this construct as either “self-continuity” or “future self-continuity” throughout the rest of this thesis.

control and manipulate cognitive “images” through all sensory modalities (i.e., touch, smell, taste, hearing, sight; e.g. Katz, 1983; White, Sheehan, & Ashton, 1977).

Cognitively imagined representations of the self can adopt a first- and third-person perspective. On the one hand, a first-person perspective allows for a phenomenological sense of uniqueness over time and evokes emotions linked to the concrete features of a situation or self (Moore & Barresi, 2013). On the other hand, a third-person perspective leads people to integrate the image of the future self with more general self-knowledge and evokes emotions related to the meaning of the events in one’s future (Libby & Eibach, 2011). Furthermore, future self-continuity is likely to be increased following the imagination of *vivid* images of one’s future self, as these induce strong emotions and may allow a person to empathetically connect to future self as they do with other beings (Johnson, Cushman, Borden, & McCune, 2013).

As such, the ability to vividly imagine future self as existing in multiple, distinct ways through first and third person imagery can foster the understanding that events involving present self have implications for future self. In turn, a heightened sense of continuity with one’s future self is likely to encourage a person to be less impulsive about decisions that could negatively impact the self further down the road and as a consequence, reduce procrastination. Given these proposed relations, the purpose of my thesis research was to explore the effect of mental imagery of this sort in reducing procrastination.

I begin my thesis with a review of the procrastination research literature, and how procrastination relates to future self-continuity. With this temporal understanding of procrastination established, I then turn to a discussion of self-continuity and the

temporally extended self. In this section, I provide an overview of self-continuity and summarize research highlighting the importance of feeling connected to our future selves for cognition and adaptive functioning. I then turn to a review of mental imagery. In this section, I examine early research on mental imagery and specify findings on vividness of imagery and its influence on emotional response, empathy, and decision-making.

Following this review, I discuss findings on first and third person imagery and their relation to emotion and decision-making. Lastly, I end my literature review with a brief conceptualization of mental imagery as an adaptive cognitive resource by examining the instance in which vivid cognitive images and empathy may operate to increase future self-continuity and, in turn, possibly reduce procrastination.

Having established the relations amongst self-continuity, procrastination, and mental imagery, I turn to an explanation of my specific hypotheses. These involve the role of the vividness of the image of future self and empathy for future self as predictors of change in future self-continuity. My hypotheses also involve the role of future self-continuity as a predictor of procrastination. I tested the relations among these variables in an experimental study using university students. Finally, I discuss the results of my study and its implications for understanding the temporal self and procrastination.

Conceptualizing procrastination

Not many things are more detrimental for adaptive functioning than being under the impression that one is “stuck,” unable to move forward with a project, a relationship, or with life in general (Little, Salmela-Aro & Phillips, 2007; Little, 1999b). However, moving forward means that one has to get started everyday on projects that can be

challenging, unfulfilling, or simply boring (Van Eerde, 2003). Even before the word ‘later’ is uttered out loud, aversive tasks often get pushed to the bottom of the to-do list, awaiting for tomorrow to wave its magic wand and infuse future self with the desire to conquer an ever-growing mountain of responsibilities (Pychyl, Lee, Thibodeau, & Blunt, 2000; Sirois & Pychyl, 2013). This is procrastination undermining our goal pursuit and well-being.

Procrastination has been defined as the voluntary delay of an intended action ensuing from self-regulatory failure (eg., Tice & Bratslavsky, 2000; Sirois & Pychyl, 2013; Steel, 2007). Researchers have linked this inability to overcome short-term temptations to specific task properties (Blunt & Pychyl, 2000; Van Eerde, 2003), such that anxiety and negative emotions consequential to aversive tasks have been found to encourage the neglect of long-term goals in favour of short-term satisfaction. Incidentally, a strong negative relation has been identified between trait procrastination and conscientiousness (Lay & Brokenshire, 1997; Lay, 1998; Watson, 2001). Quite the opposite of procrastination, this disposition is characterized by socially prescribed self-regulatory control resulting in goal-directed behaviours such as delaying gratification, following norms and rules, and planning, organizing, and prioritizing tasks (John & Srivastava, 1999).

What has become increasingly clear is that a lack of task prioritization or proper time management is not at the root of procrastination, and that it may be more appropriate to conceptualize this self-defeating delay within a larger class of self-regulatory problems, such as avoidant coping strategies (Sirois and Pychyl, 2013). Under this definition, an individual procrastinates when faced with an aversive task because of an

increase in negative emotions. In fact, the negative emotional states associated with the notion of *having* to complete a negative, challenging, or boring task (Van Eerde, 2003) will necessitate stronger cognitive control. Consequently, individuals are more likely to discount their long-term goals in an attempt to cope with these negative emotions by pulling away from the aversive task; a behaviour researchers are calling “short-term mood repair” or more colloquially, “giving in to feel good” (Tice & Bratslavsky, 2000; Tice, Bratslavsky, & Baumeister, 2001; Sirois & Pychyl, 2013).

For example, Tice, Bratslavsky, and Baumeister (2001) have found that attempting to regulate negative emotions impairs delay of gratification when people think their affective states can be altered. In an experiment, one group of participants was told that aromatherapy had the capacity to freeze a person’s mood and would render any attempt at changing one’s mood unsuccessful. Following these instructions, participants were instructed to play a problem-solving computer game. In this game, participants played the role of a fisherman and were told they could catch as many fish as they wanted per trial. However, fish could only reproduce according to the number left in the lake prior to each subsequent trial, and the game would end when no fish were left in the lake. Results indicated that following an emotional distress manipulation, participants who believed their mood could be changed delayed gratification less effectively (i.e., caught more fish in early trials) than participants who believed that their mood was frozen. As such, it can be said that procrastinators “give in to feel good now” (Tice & Bratslavsky, 2000; Tice, Bratslavsky, & Baumeister, 2001) because they believe that pulling away from the aversive task will improve their present emotional state.

Research by Pychyl, Lee, Thibodeau, et al. (2000) has demonstrated that engaging in procrastination is in fact effective at changing one's immediate emotional state such that negative emotions are reduced and positive emotions increased. However, results also indicated that procrastination leads to increases in guilt and decreases in motivation. Consequently, these findings demonstrate that such behaviour is self-defeating for future-self and makes little sense in terms of adaptive, long-term, and rational decision-making.

The belief that future self will actually *feel* like doing the aversive tasks delayed by present self indicates a disconnection between one's temporally extended self. In fact, research has found that individuals who procrastinate tend to base decisions on present emotional states and rarely project themselves into the future (Ferrari & Diaz-Morales, 2007; Specter & Ferrari, 2000). Although the concept of self has been thought to persist through time (Barresi & Moore, 1996), procrastinators may be fragmenting the relationship to their future self by favouring a present perspective.

Consequently, this self-discontinuity can make a person perceive future self as they would a stranger. Such a perception is likely to diminish the importance of the possible consequences resulting from procrastination, such as anxiety, depression (Ferrari, 1991; Haycock, McCarthy, & Skay, 1998; Lay, Edwards, Parker, & Endler, 1989; Martin, Flett, Hewitt, Krames, & Szanto, 1996; Senecal, Koestner, & Vallerand, 1995), stress (Flett et al., 1995; Sirois, Melia-Gordon, & Pychyl, 2003; Tice & Baumeister, 1997), and shame (Fee & Tangney, 2000). Ultimately, this lack of connection to one's future self can further perpetuate procrastination and favour a cycle of self-defeating behaviour (Sirois & Pychyl, 2013; Ferrari & Diaz-Morales, 2007; Jackson, Fritch, Nagasaka, & Pope, 2003). Accordingly, it is of great importance to better

our conceptualization of the temporally extended self in relation to procrastination in order to improve our understanding of this self-defeating delay.

Conceptualizing the temporally extended self

The development of consciousness has brought humans the ability to control thoughts and behaviours through a heightened awareness of ongoing experience (Searle, 2005). Although academic and theological discussions on the matter have produced a number of diverging theories (please refer to Seager, 2002 for an introductory review), it has been agreed that consciousness is a central part of the *subjective* experience underlying awareness of self and personal identity (Moore & Barresi, 2013).

As such, our awareness of self develops at around the second year of life (Povinelli, 1995; Neisser, 1997) and persists in time such that we constantly feel that we are separate from others around us and produce perceptions, feelings, and behaviours that are uniquely our own (Barresi & Moore, 1996). The self achieves temporal continuity by integrating past and future events into present awareness. As such, a person who is able to look back at past experiences to inspire future events should feel a continuous sense of identity that helps guide present behaviour (Bird & Reese, 2008).

Self-continuity is important for well-being as it provides coherence between who one used to be, is, and who one desires to become (Chandler, 1994). It is through a coherent and stable sense of self-continuity that a person is able to properly interpret and organize information, generate appropriate emotional responses, and effectively guide goal-oriented action necessary for the execution of daily behaviours (Damasio, 2010; Greenwald, 1980). Since future affective and goal states are made more vivid through

self-continuity, a strong connection to future self should facilitate impulse control and favour long-term goal pursuit.

In fact, support for the idea that future self-continuity can help a person adaptively cope with negative situations has been highlighted in research by Sadeh and Karniol (2012). Results of this study demonstrated that people who had suffered job loss reported lower self-continuity and demonstrated less adaptive coping over time. However, people who suffered job loss but maintained a continuous sense of self were able to use adaptive coping strategies such as seeking social support and approaching challenging tasks when facing job loss (Sadeh & Karniol, 2012).

These findings illustrate that people who experience high self-continuity are able to link their past employed self and project it into the future. Doing so reduces the weight of the present unemployed self as the sole reference for identity and allows behaviour to be organized in a way that will not only benefit present self, but that will also ensure lasting positive outcomes (i.e., employment) for future self.

As highlighted in the above study, it is also common for people to experience self-discontinuities such that the past and future self feel too detached to offer positive guidance for present behaviour. This lack of “personal sameness across time” (James, 1985) may be due to the fact that people do not naturally feel similar to a self that extends too far into the past or future. Since people experience many multiple selves throughout their lifetime, how connected one feels to these identities is highly dependent on the time that has passed between each self (Parfit, 1971, 1987). In fact, self-continuity varies so much across time that certain people perceive their future self as they would a stranger, which can in turn lead to self-defeating behaviour and maladaptive ways of coping, such

as procrastination (Zimbardo 1999; Sirois & Pychyl, 2013). Indeed, a series of three correlational studies by Blouin-Hudon and Pychyl (2015) have demonstrated that feeling less connected to future self both in ten years and in two months' time is predictive of increases in procrastination behaviour.

These self-discontinuities experienced by procrastinators may in part be explained by present-self biases. In fact, research has found that people exhibit present-self biases that can make it difficult to perceive future self as an extension of who they are today (Pronin & Ross, 2006; Wakslak, Nussbaum, Liberman, & Trope, 2008). In a study by Pronin and Ross (2006), participants were given a list of opposing adjectives such as "serious-carefree," "cooperative-competitive," and "introverted-extraverted," and asked to circle the adjective that more accurately represented themselves today, themselves in five years, a friend today, and a friend from five years ago. Participants also had the option to circle "variable/depends on the situation" for traits that did not always feel stable across situations. Results indicated that participants ascribed stable personality traits to their future self and past friend while they perceived their present self as more flexible across circumstances. These findings extend to the self-continuity and procrastination literature by demonstrating that people low on future self-continuity may be naturally inclined to perceive future self as someone that does not behave like them, and who in turn will react to challenges and unpleasant situations differently than they do.

Neuroscience research parallels these findings by illustrating that certain areas of the brain activate differently for future self than for present self. In a study by Ersner-Hershfield, Wimmer and Knutson (2009), participants low on future self-continuity

showed similar neural activations when they thought about their future self as when they imagined a stranger. Specifically, the Cortical Midline structures of the brain responsible for self-evaluation, communicating socioemotional significance, and weighing information according to motivational importance were only activated when low self-continuity participants thought about themselves, not when they thought of others or of future self (Ersner-Hershfield, Wimmer, & Knutson, 2009b; Northoff & Bermpohl, 2004).

Interestingly, an important entity of the Cortical Midline structure, the Anterior Cingulate Cortex (ACC), is connected to brain structures related to cognition, emotion, and reward processing (Ongur, An, & Price, 1998; Vogt & Pandya, 1987). One role of the ACC is to detect discrepancy between a habitual response tendency and a competing goal, such as resisting temptation to favour long-term gains, and signal the need for increased cognitive control regarding these competing states (Botvinick, Braver, Barch, et al., 2001; McClure, Botrinick, Young, et al., 2007).

The fact that the ACC is not activated when thinking of future self for people experiencing low future self-continuity means that competing emotional and goal states experienced in the present may not be perceived as relevant for future self. In other words, people might non-consciously suppose that future self will adaptively cope with aversive tasks; that a similar situation will not once again provoke negative emotions culminating in short-term mood repair and inevitably perpetuate the cycle of procrastination. Overall, these findings indicate that future self-continuity can be fragmented when people feel emotionally different from their future selves (Ersner-Hershfield et al, 2009).

With regards to interpersonal processes, emotional distance indicates a lack of empathy for others and an inability to make decisions on their behalf. In fact, empathy requires the ability to feel another person's emotions in an attempt to share subjective experience (Hodges & Klein, 2001). Since emotions communicate the motivational value and costs of particular behaviours (Berridge, 2007; Aarts, Custers, & Holland, 2007), the inability to perceive and empathize with future self's emotional states could explain why some people make impulsive decisions with negative long-term consequences (Eisenberg & Miller, 1987).

Indeed, ethical decision-making relies heavily on weighing the moral and physical consequences associated with particular actions (Jones, 1991). However, individuals who are low on self-continuity are more likely to make unethical decisions such as lying, bribing, and cheating (Hershfield, Cohen, & Thompson, 2011). These short-term decisions are a good example of lack of empathy for future self as they increase the risk for debilitating consequences such as job loss, imprisonment, and loss of income (Cohen, 2010).

Even this cursory review of the literature has highlighted important findings on self-continuity. Self-continuity offers coherence between the past, present, and future self and facilitates long-term decision-making by favouring goal-oriented action and adaptive emotional response to aversive situations (Chandler, 1994; Damasio, 2010; Greenwald, 1980). However, it is possible that feeling emotionally different from future self can fragment self-continuity by reducing empathy and biasing assumptions of future coping behaviour (Pronin & Ross, 2006; Ersner-Hershfield et al, 2009; Cohen, 2010). Consequently, low self-continuity can lead to self-defeating behaviours such as unethical

decision-making (Hershfield, Cohen, & Thompson, 2011) and maladaptive coping, such as procrastination (Zimbardo 1999; Sirois & Pychyl, 2013; Blouin-Hudon & Pychyl, 2015).

In spite of these findings, the question remains: what are individuals low on future self-continuity missing in order to feel more similar and connected to future self? One line of inquiry can be found in the idea that the inability to extend the self into the future is due to a failure of the imagination (Parfit, 1971). As such, it can be argued that it is our unique capacity for *imagination* that allows us to create a heightened sense of self-continuity across time (Neisser, 1988). In order to understand what I mean, we need to consider research that shows how vivid first- and third-person mental imagery benefit emotional and empathetic relations to future self.

From imagination to imagery: Fostering the temporally extended self

Emotion, empathy, and vividness. The awareness of ongoing experience and thoughts engendered by consciousness (Searle, 2005) decidedly rests on the human ability for imagination (Ellis, 1995). Indeed, the primary role of the imagination is to bring mental objects that are not currently perceived by the senses to present consciousness (Byrne, 2005; Angell, 1906). These mental objects can in turn be manipulated and constructed into creative, aesthetic, and expressive narratives that offer humans a unique way of understanding the physical, psychological, and social world surrounding daily life (Moore & Barresi, 2013).

While creative, aesthetic, and expressive thoughts broadly define the imagination, philosophy has long considered our capacity for imaginative thought to

transpire specifically from mental images. Indeed, it is in his theory of memory and thought that Aristotle argued that images were so fundamental to fantasies of the future and memories of the past that it was “impossible to think without an image” (Thomas, 2014). He also believed that the image of a remembered or fantasized object played a central role in motivating behaviour towards a desired reality (Nussbaum, 1978).

Mental imagery has been conceptualized in the psychological literature as the ability to control and manipulate cognitive “images” through all sensory modalities (i.e., touch, smell, taste, vision, hearing), although these are most often experienced in the “mind’s eye” through visual processing (Spence & Deroy, 2012; Serruya & Grant, 2009; Katz, 1983; White, Sheehan, & Ashton, 1977). Imagery has also been explored in social psychology in terms of possible selves (Markus & Nurius, 1986). Reflecting Aristotle’s arguments, the image of one’s possible future self –what one would like to become or not to become –was found to be a strong predictor of goal-oriented behaviour such that mentally holding the image of oneself voting was a direct predictor of actual voting behaviour (Libby et al., 2007).

As such, people who produce a mental image of their future self performing a desired action are more likely to regulate their present behaviour in order to achieve an imagined future (Bandura, 1997; Neck & Manz, 1992). However, the ability to hold in mind and manipulate a mental image is only one of the two central properties of a person’s imagery ability –the other facet being the ability to vividly perceive mental images (Katz, 1983; White, Sheehan, & Ahston, 1977).

Mental imagery interventions have been adopted in a variety of domains such as health, education, and sport in order to increase the vividness of cognitively rehearsed

action or thoughts. These techniques have been helpful in reducing pain (Roffe, Schmidt, & Ernst, 2005; MacIver, Sacco, & Nurmikko, 2011) and at increasing self-regulatory sleep strategies (Loft & Cameron, 2013). In education, learning-disabled children have greatly benefited from vivid mental imagery use in developing associative learning skills (Greeson, 2006).

Mental imagery has also been central to sport psychology interventions and research for over fifty years (e.g., Smith, 1991). This technique has been widely employed by athletes, coaches, and psychologists as complementary training to physical practice in order to increase performance (Martin, Moritz, & Hall, 1999). While my thesis research is not concerned with performance per se, findings from this body of literature offers a strong empirical foundation for furthering our understanding of mental imagery as a tool to increase vividness of future self. For example, a study by Callow, Roberts, and Fawkes (2006) has demonstrated that downhill skiers who imagined themselves completing a downhill ski-slalom course experienced increases in vividness of imagery. Extending these findings, research by Nobbe, Nilsen, and Gillen (2012) has highlighted that participants who used mental imagery twice per week for six consecutive weeks demonstrated a 22% increase in imagery vividness. While the scope of these results is limited by small sample sizes, both of these studies empirically support the idea that adopting a consistent mental imagery practice can be beneficial in increasing imagery vividness. Consequently, I expect future self to become increasingly more vivid following a mental imagery intervention.

Of great interest, research by Hershfield and colleagues (2011) bridges mental imagery, self-continuity, and procrastination literatures by demonstrating that vivid

representations of future self help sustain future self-continuity and favour long-term decision-making. In these studies, participants were instructed to enter a virtual reality environment where they were faced with a digitally aged avatar of themselves (experimental) or with an avatar of their current self (control). A confederate then asked participants questions about themselves to enhance identification to the avatar. Following these questions, participants were subjected to a hypothetical monetary allocation task to determine how much they were willing to save for retirement. Results demonstrated that participants felt more similar to their future self following digital aging and were more willing to discount present rewards (i.e., more money today) in order to increase long-term gains (i.e., more money for retirement).

Although these results are promising for procrastination interventions, this method of using individual sessions with avatars of future self can be costly and may not be available to social institutions that would benefit the most from this technology, such as schools, health sectors, and workplaces. However, the research reported by Hershfield and his colleagues offers a strong theoretical foundation for exploring how mental imagery, a cognitive tool with which every human is equipped, can increase future self's vividness (Callow, Roberts, & Fawkes, 2006; Nobbe, Nilsen, & Gillen, 2012), emotional states (Kosslyn et al., 2001; Damasio, 1999; Holmes et al., 2006), foster empathy (Johnson, Cushman, et al., 2013), and in turn, increase self-continuity (Hershfield et al., 2011).

In fact, mental imagery has long been thought to have a direct association to emotions. Certain researchers even consider emotions to be inseparable from imagery (e.g., Ley, 1979), as it has the capacity to stimulate physiological arousal similar to or of

even greater intensity than direct perception (Sheikh & Kunzendorf, 1984; Ellis, 1962). Recent neuroimaging techniques have supported these conclusions by highlighting that direct perception and mental imagery recruit the same neurological substrates and indeed, lead to comparable physiological and emotional activations (e.g., Kosslyn, Ganis, & Thompson, 2001; Damasio, 1999).

Furthermore, Holmes and colleagues (2006) have found that participants who were guided through a mental imagery narrative of positive events experienced greater increases in positive affect than did participants instructed to focus on the verbal meaning of the same events. These findings demonstrate that mental imagery is superior at motivating decision-making than immersion, creative scrutiny, and verbal processing, precisely because it intensifies future self's emotional states through rich perceptual processing, cognitive flexibility, and physiological arousal (Holmes, Mathews, Dalgleish, & Mackintosh, 2006; Holmes, Matthews, Mackintosh, & Dalgleish, 2008; Blair, Ma, & Lenton, 2001).

Although a person cannot physically meet his or her future self, this evidence demonstrates that mental imagery can be highly efficient in simulating such an experience. By inducing future self's emotional and phenomenological experience in the present, mental imagery allows a person to connect to future self in a way that might otherwise be impossible. Indeed, Blouin-Hudon and Pychyl (2015) provided initial support for this idea by demonstrating that participants who were able to form more vivid mental images also generally experienced more positive affective states. Trait vividness of mental imagery and positive affective states were also predictive of increases in future self-continuity in ten years and in two months.

Considering the extreme complexity of human experience when accounting for cognitive-affective orientations (Izard, 1977; Tomkins, 1962), it follows that empathy – which requires the ability to feel another’s emotions and to adopt the perspective of another – is likely to parallel the emotional saliency of an imagined future self and inspire the sharing of subjective experience (Hodges & Klein, 2001). As a consequence, a dynamic, multi-sensory, and complex experience of future self is likely to allow the person to regulate decision-making within a broader cognitive-affective scope and guide behaviour in ways that are beneficial for long-term well being.

Turning to interpersonal processes, research by Johnson, Cushman, et al. (2013) has found that a person is likely to feel an increased connection to others following a mental imagery manipulation. Results of this study demonstrated that participants who generated highly vivid images of a fictional narrative reported higher empathy for the story’s characters and were more likely to adopt pro-social behaviours. Complimentary to these conclusions, a study by Cialdini, Brown, Lewis, et al., (1997) demonstrated that participants who felt more empathic concern also experienced greater self-other overlap. In fact, participants who reported higher empathy felt an increased sense of “oneness” such that experiencing another’s emotions led participants to incorporate their sense of self within the boundaries of the other.

This literature directly supports the claim that vivid mental images foster a sense of connection to others by facilitating access to another’s emotional states. Consequently, the empathic connection inspired by these emotions (Cwir, Carr, Walton, & Spencer, 2011) fragments the boundary separating self from other (Cialdini, Brown, Lewis, et al., 1997) and enables the self to regulate behaviour within a broader cognitive-affective

scope. Since the boundary separating present and future self can foster a sense of “otherness” (Hershfield et al., 2009; Parfit, 1971), a mental imagery manipulation aimed at increasing vividness and empathy for future self may thus be essential for increasing future self-continuity and in turn, reducing procrastination.

From first to third-person imagery: perspective is key. As I have previously reviewed, vivid mental imagery can have an important influence on emotion, empathy, and self-continuity. However, the perspective with which a person images himself or herself also has a decisive impact on the affective magnitude and intensity induced by the mental image. In fact, some authors argue that mental imagery intensifies future self’s emotional states only if a person images themselves from a first-person perspective (i.e., Holmes, Coughtrey, & Connor, 2008).

Indeed, imaging events through future self’s eyes evokes strong emotions about the concrete features of a situation and fosters a phenomenological sense of uniqueness (Moore & Barresi, 2013). On the contrary, people adopt a third-person perspective when imaging temporally distant events (D’Argembeau & Van der Linden, 2004) and when thinking about behaviours that conflict with the present self-concept (Libby & Eibach, 2002). It has also been argued that third-person imagery reduces the emotional impact of an imagined future event or self (i.e., Holmes & Mathews, 2010; Sutin & Robins, 2010). As such, people subjected to a third-person imagery manipulation are likely to perceive future self as a distant stranger, which can in turn lead to impulsive decision-making and maladaptive coping (Zimbardo 1999; Sirois & Pychyl, 2013). On the other hand, people subjected to a first-person mental imagery manipulation are likely to feel like perceptions, feelings, and behaviours unique to present self also extend to future self

(Barresi & Moore, 1996). With this visceral connection to future self, people are in turn more likely to weigh the long-term consequences of their present behaviours and are less likely to procrastinate (Blatt & Quinlan, 1967).

Recent findings, however, have demonstrated that mental imagery is most useful to self-continuity when a person is able to image future self through various perspectives. For example, research by Libby and Eibach (2011) has found that imaging future self from a third-person perspective leads people to integrate pictured events with a more general self-knowledge. As an outcome of this perspective, emotions attached to the meaning of the future event with regards to a person's beliefs, values and broad goals was found to foster a conceptual –rather than phenomenological –connection to future self (McAdams, 2001). As such, experiencing future self's emotional reactions to specific events through first-person imagery, while also conceptualizing the broad emotional impact of situations on future self's values and goals through third-person imagery, may both be essential for fostering and maintaining self-continuity. In turn, these diverse images allow for a complete and dynamic construction of future self as an emotional reflection of present self and should increase motivation to overcome short-term obstacles and encourage adaptive decision-making (Vasquez & Buehler, 2007).

Taken together, the studies summarized so far highlight important findings on mental imagery and its ability to foster self-continuity. Most importantly, mental imagery is central to imaginative thought and is most often experienced through visual processing (Serruya & Grant, 2009; Katz, 1983; White, Sheehan, & Ashton, 1977). More specifically, *vivid* mental imagery may be essential for self-continuity as it intensifies the emotional and empathic connection to future self (Holmes, Mathews, Dalgleish, &

Mackintosh, 2006, 2008; Blair, Ma, & Lenton, 2001). Furthermore, while past research has argued that third person mental imagery fragments self-continuity and reduces the emotional impact of an anticipated event (D'Argembeau & Van der Linden, 2004; Libby & Eibach, 2002), recent findings have demonstrated that mental imagery may be most useful when future self is imagined both through an experiential first-person and a conceptual third-person perspective (Libby & Eibach, 2011; Conway, 2005; Vasquez & Buehler, 2007).

The findings that I have reviewed in the previous sections provide sufficient evidence for anticipating that mental imagery can be used as an effective tool for procrastination intervention. Specifically, using mental imagery as an intervention tool is likely to increase vividness of imagery (Nobbe, Nilsen, & Gellen, 2012; Callow, Roberts, & Fawkes, 2006), the emotional and empathic salience of future self (Ley, 1979; Holmes, Mathews, Dalgleish, & Mackintosh, 2006; Holmes, Matthews, Mackintosh, & Dalgleish, 2008; Blair, Ma, & Lenton, 2001; Johnson, Cushman, et al., 2013; Cialdini, Brown, Lewis, et al., 1997), and foster self-continuity (Ersner-Hershfield et al., 2009). In turn, a person will be able to draw upon the emotional and motivational resources provided by an increased sense of continuity with future self to gain a broader perspective of long-term versus short-term gains and facilitate adaptive long-term decision making.

Based on this theory and research related to mental imagery, the goal of my thesis was to explore the role of: 1) empathy, emotions, and vividness of future self in the relation of 1st/3rd-person mental imagery and future self-continuity, and 2) future self-continuity in predicting procrastination.

Ultimately, the rationale for my masters research was that gaining more information on these constructs is important to further our understanding of how mental imagery utilizes different psychological resources –both cognitive and affective –to influence the sense of the self as being continuous over time or as disconnected and fragmented. By understanding the association between mental imagery and future self-continuity, researchers can in turn more accurately explain the role of the temporally extended self in relation to procrastination.

As such, the present study was experimental with a three time-point longitudinal design (i.e., Time 0 = pre-intervention, Time 1 = two-week mark, Time 2 = four-week mark). Specifically, I asked participants to fill out a pre-intervention questionnaire (Time 0) assessing baseline trait empathetic concern and perspective taking, trait vividness of mental imagery, vividness of future self, emotions for future self, and affective empathy for future self, before being randomly assigned to a four-week mental imagery or meditation practice. During the intervention, participants were instructed to practice their respective condition (i.e., mental imagery, meditation) twice per week for four consecutive weeks. At the two-week mark (Time 1), participants were asked to fill out a half-point questionnaire containing the same measures as the Time 0 questionnaire. After the intervention was complete, participants were asked to fill out a post-intervention questionnaire to assess change in emotions for future self, empathy for future self, vividness of future self, future self-continuity, and procrastination (Time 2). This questionnaire also contained the same measures as the Time 0 and Time 1 questionnaires.

Hypotheses

With this basic understanding of the experimental design (which I describe in more detail in the next section), I hypothesized the following:

Hypothesis 1a: Future self-continuity, positive emotions for future self, affective empathy for future self, and vividness of future self at Time 2 will be significantly higher for the mental imagery condition than the meditation condition.

Hypothesis 1b: Procrastination at Time 2 will be significantly lower for the mental imagery condition than for the meditation condition.

Hypothesis 2: Positive emotions for future self, affective empathy for future self, and vividness of future self at Time 1 will mediate the relation of condition at Time 0 and future self-continuity at Time 2.

Hypothesis 3: Future self-continuity at Time 2 will significantly predict decreases in Procrastination at Time 2. More specifically, the mental imagery condition scores on Future self-continuity will predict significantly more decrease in procrastination than the meditation condition scores.

Method

Participants

To be selected for this study, participants had to be Canadian residents and be enrolled full-time or part-time at Carleton University. Although university student samples are extremely convenient, easily accessible, and overly used in social/personality psychology research, this population was nonetheless relevant for my experiment because of the magnitude of procrastination in academic settings, with 80%-95% university

students reporting to have procrastinated on academic tasks (Ellis, & Knaus, 1977; Solomon & Rothblum, 1984).

Participants were recruited through the Psychology Participant Pool/SONA system. As such, students enrolled in Psychology 1001, 1002, 2001, and 2002, and Neurology 2001 and 2002 classes had the chance to gain 4% of their total grade by enrolling in the present intervention study.

Out of the 231 participants who signed up for the present study, 201 completed the Time 0 questionnaire (70% females, 30% males). Participants in this sample were aged between 17 and 42 years old ($M = 21.15$, $SD = 4.89$) and were mainly enrolled full time (89.3%) in their first (53%), second (27.3%), third (12.1%), and fourth year (7.6%) at Carleton University. Of those who completed the Time 0 questionnaire, 8 participants only filled out the demographics section of the questionnaire and as such, were removed from the sample. At Time 0, the final sample included a total of 193 participants who were randomly assigned to the mental imagery ($n = 93$) or meditation condition ($n = 100$). At the two-week mark, a total of 151 participants (mental imagery $n = 77$; meditation $n = 74$) completed the Time 1 questionnaire. Finally, a total of 159 participants (mental imagery $n = 80$; meditation $n = 79$) completed the Time 2 questionnaire.

Measures

Procrastination. Procrastination was assessed using Haghbin and Pychyl's (2014) *Multidimensional Measure of Procrastination* (MMoP; Appendix A). The MMoP was developed to measure various aspects of academic procrastination and its associated

emotions and cognitions. As such, the MMoP consists of five main sections: procrastination behaviour (35 items) dissatisfaction and undesired outcome (40 items), negative emotions (20), irrationality (19 items), and duration (19 items). All items are measured on a 1 (*never*) to 6 (*always*) Likert-type scale. In this study only a selection of items related to the behaviour section were used. In addition to the main items, task reflection questions are presented the beginning and at the end of survey, which list tasks that students are typically faced with in an academic setting (i.e., exam preparation, writing assignment, assigned readings, writing term paper, essay writing, writing thesis, lab report, illustration projects or drawing, problem sets, questions on readings or discussions, presentation, practical project, group project).

The behaviour section consists of two subscales: Irrational and hedonistic procrastination. Sample items for irrational procrastination include: “I plan to work on academic tasks ahead of time, but when the time comes, I needlessly postpone the tasks” and “Just before I am about to begin an intended academic task, I tend to avoid it by doing something else.” Sample items for hedonistic procrastination include: “I do not really care if I get a bad grade due to working on an academic task at the last minute” and “I plan and do fun activities (e.g., partying, going out, sports) as opposed to plan and work on academic tasks ahead of time.” Both scales have demonstrated excellent levels of internal consistency for this study at all three time-points (Irrational: Time 0 $\alpha = .976$, Time 1 $\alpha = .977$, Time 2 $\alpha = .980$; Hedonistic: Time 0 $\alpha = .951$, Time 1 $\alpha = .962$, Time 2 $\alpha = .969$), and both scales have demonstrated excellent construct validity (Haghbin, 2015).

Future Self-Continuity. How connected participants feel to their future self at *the end of the semester* was assessed using Ersner-Hershfield, Garton, Samanez-Larking, and Knutson's (2009) *Future Self-Continuity Scale* (Appendix B). The index of Future self-continuity was based on the Inclusion of the Other in the Self scale (Aron, Aron, & Smollan, 1992) and was developed for a study assessing whether perceiving the future self as a stranger or as the continuous extension of the present self could predict how much an individual would save for retirement.

Future self-continuity was measured by one item on a 7-point scale marked at each point by two circles that ranged from depicting no overlap to depicting almost complete overlap. Participants were told: "Sometimes our future selves can feel very close to us, like a good friend, or very distant as if they were a stranger. On the scale below, please indicate how similar/connected you feel to your future self at the end of the semester. Circles that overlap represent greater closeness to the future self." This item was rated on a scale ranging from 1 (*not similarity/connected at all*) to 7 (*completely similar/connected*). Higher scores were judged to indicate more continuity with one's future self. The test-retest reliability for the present scale was good across all three time points ($\alpha = .765$).

Positive and negative emotions for future self. Positive and negative emotions felt towards future self were assessed using a *modified Differential Emotions Scales* (see Izard, 1977 for the original, see Waugh & Fredrickson, 2006 for the modified version; Appendix C). The original Differential Emotions Scale is a self-report instrument based on Izard's (1977) Differential Emotions Theory and was designed to assess individual phenomenological experience of the ten fundamental emotions (i.e., interest, enjoyment,

surprise, distress, anger, disgust, contempt, fear, shame/shyness, and guilt; Darwin, 1872; Ekman, Friesen, & Ellsworth, 1972; Izard, 1971; Tomkins, 1962). The original measure contained 30 items, three for each fundamental emotion, to assess the entire range of human emotions or combination/patterns of emotions.

I decided to include a modified version of the Differential Emotions Scale (Waugh & Fredrickson, 2006) as it has been used in studies employing recent theories of emotion, such as Fredrickson's (2001) Broaden-and-Built Theory, and is empirically appropriate for measuring emotions under the assumptions of these recent theories. As such, participants were asked to: "please close your eyes and imagine your future self at the end of the academic semester". After doing this exercise, participants were asked to: "Rate how much you have experienced each emotion when thinking of your future self at the end of the academic semester". Participants were instructed to indicate how often they felt each of 20 emotions on a scale ranging from 0 (*not at all*) to 7 (*extremely*).

The positive emotions subscale consisted of 11 items (i.e., amused, awe, content, joyful, grateful, hopeful, interested, love, proud, sympathy, surprise) and has demonstrated very good internal consistency in this study at Time 0 ($\alpha = .860$), Time 1 ($\alpha = .908$), and Time 2 ($\alpha = .892$). For the purposes of my thesis, I omitted both "surprise" and "sympathy," as these adjectives were repeated when assessing affective empathy. Furthermore, these items are not usually included in subscales of positive emotions (Waugh & Fredrickson, 2006). The negative emotions subscale consisted of 8 items (i.e., angry, contempt, ashamed, disgust, sad, scared, guilty, embarrassed) and has demonstrated very good internal consistency in this study at Time 0 ($\alpha = .922$), Time 1 ($\alpha = .914$), and Time 2 ($\alpha = .944$).

Affective Empathy for future self. Empathy experienced towards future self was assessed using Batson, Early, and Salvarani's (1997) *Affective Empathy Scale* (Appendix D). This measure was developed to determine if empathy truly leads to altruistic behaviour (Batson, Dyck, Brandt, et al., 1988). In these studies, Batson and his colleagues used 6 adjectives of emotions that have been found to load on the empathy factor (i.e., sympathetic, compassionate, softhearted, tender, moved, warm) and 8 adjectives that have been found to load on the distress factor (i.e., alarmed, grieved, troubled, distressed, upset, disturbed, worried). Both empathy and distress indexes have been found to be orthogonal, with internal consistency ranging from .79 to .95 across studies. The distress index is used to test egotistical reactions to a situation where another person is in need of help. As such, these studies have found that individuals who score high on the distress index are less likely to help someone in need, even if they experience high empathy.

I chose this particular empathy measure because some subset of these items has been used in nearly every study of the empathy-altruism hypothesis in the past 20 years and support that empathy manipulations do in fact manipulate empathy (e.g., Batson, Turk, Shaw, & Klein, 1995; Coke, Batson, & McDavis, 1978; Toi & Batson, 1982). Furthermore, this measure was used alongside the Inclusion of Other in the Self Scale (Aron, Aron, & Smollan, 1992) –the measure on which the Future Self-Continuity Scale was based (Ersner-Hershfield et al., 2009) –to investigate if individuals who scored high on the present empathy index when thinking of their friend would experience higher self-other overlap (Cialdini et al., 1997). Because my study involved empathy for future self –

which is an egotistical orientation in and of itself –I omitted the distress index and only included a subscale of the 6 empathy index items.

Accordingly, participants were asked to: “please close your eyes and imagine your future self at the end of the academic semester. Rate how much you have experienced each emotion when thinking of your future self at the end of the academic semester.” Each item was rated on a scale ranging from 1 (*not at all*) to 7 (*extremely*). The empathy index demonstrated very good internal consistency in this study at Time 0 ($\alpha = .919$), Time 1 ($\alpha = .941$), and Time 2 ($\alpha = .936$).

Vividness of future self. Based on Mark’s (1973, 1987) *Vividness of Imagery Questionnaire*, participants were asked to “Please close your eyes and imagine your future self at the end of the academic semester. Rate the vividness of the visual image, touch, smell, and sound of your future self at the end of the academic semester” (Appendix E). Specifically, participants were asked to rate the degree of vividness of future self for each sensory modality on a scale ranging from 1 (*No image at all, you only “know” that you are thinking of you future self*) to 5 (*Perfectly clear and as vivid as normal vision, smell, taste, touch, and/or hearing*). This item demonstrated good test-retest reliability across all three time points ($\alpha = .719$).

Control measures

Trait Vividness of imagery. Marks’ (1973; 1987; Appendix F) *Vividness of Imagery Questionnaire* was used to assess participants’ natural ability to form vivid visual mental images. Scores were used to statistically control for this disposition in order

to isolate the variance of change in mental imagery vividness that was due to the experimental manipulation.

The questionnaire is composed of sixteen items referring to different situations that participants were asked to imagine (e.g., “Visualize a rising sun. Consider carefully the picture that comes before your mind’s eye”). Participants were then presented with specific items for each situation pertaining to the details of the mental image (e.g., “The sun is rising above the horizon in a hazy sky”), and were asked to rate them on a scale ranging from 1 (*No image at all, you only “know” that you are thinking of the object*) to 5 (*Perfectly clear and as vivid as normal vision*). For the purposes of my thesis, the numerical values on the 5-point rating scale initially proposed by Marks (1973) were reversed so that higher ratings represent greater vividness (McKelvie, 1995). The internal consistency of the present questionnaire was very good in this study at Time 0 ($\alpha = .925$), Time 1 ($\alpha = .939$), and Time 2 ($\alpha = .954$).

Trait empathy. Trait empathy was assessed using the *Interpersonal Reactivity Index* (Davis, 1980; Appendix G). This scale has been considered a very reliable measure of empathy because it includes both measures of cognitive and affective empathy (Baron-Cohen & Wheelwright, 2004). In fact, cognitive empathy consists of guessing other’s thoughts and feelings and visual perspective-taking, which can recruit mental imagery processes. On the other hand, emotional empathy involves feeling another’s emotions and compassion. Based on evidence for trait empathy as encompassing both cognitive and emotional dimensions (i.e., Davis, 1983), I chose to use the empathetic concern (total of 7 items, with 3 reversed items) and perspective-taking subscales (total of 7 items, with two reversed items) of the full measure. These subscales were used to control for individual

differences in this disposition (i.e., both cognitive and emotional dimensions). This was done to assess the proportion of variance of change in empathy that is uniquely due to the mental imagery intervention. Items are rated on a scale ranging from 1 (*not well at all*) to 5 (*extremely well*). Sample items include “I often have tender, concerned feelings for people less fortunate than me” and “I sometimes try to understand my friends better by imagining how things look from their perspective.” The empathic concern subscale demonstrated good internal consistency in this study at Time 0 ($\alpha = .786$), Time 1 ($\alpha = .795$), and Time 2 ($\alpha = .781$). Similarly, the perspective taking subscale demonstrated good internal consistency at Time 0 ($\alpha = .768$), Time 1 ($\alpha = .811$), and Time 2 ($\alpha = .813$).

Procedure

Participants who qualified for the study were asked to provide an e-mail address. Once I had recorded their email address in an excel file (to which only I had access), I emailed participants a link to a Time 0 (baseline) self-report questionnaire battery, which was administered online. This Time 0 questionnaire battery contained a consent form (Appendix I), demographic questions (i.e., biological sex, age, program of study, status of study, year of study; Appendix A), measures of baseline procrastination behaviour (Hagbin & Pychyl, 2014; Appendix B), future self-continuity (Ersner-Hershfield, Garton, Samanez-Larking, & Knutson, 2009; Appendix C), emotions for future self (Izard, 1977; Waugh & Fredrickson, 2006; Appendix D), affective empathy for future self (Batson, Early, & Salvarani, 1997; Appendix E), vividness of imagery of future self (Marks, 1973, 1987; Izard, 1977; Appendix F), trait vividness of mental imagery (Marks, 1973, 1987; Appendix G), and trait empathy (Davis, 1980; Appendix H).

Once the Time 0 questionnaire was completed, participants were randomly assigned to either the mental imagery condition or to the meditation condition. I chose to run the intervention twice per week for four consecutive weeks based on past studies that succeeded in finding an effect of mental imagery on the variable they were exploring (e.g., Menzies, Taylor, Bourguignon, 2006; Maciver, Lloyd, Roberts, & Nurmikko, 2008). As such, this time frame provided participants enough time to develop and improve a sufficiently vivid and rich mental image of their future self to influence changes in emotions, empathy, and vividness of future self, as well as changes in future self-continuity and procrastination if such an association truly exists.

After random assignment, participants in both conditions were sent two audio files. The first audio file was designed to familiarize participants with the concept of mental imagery (Appendix J). This first audio file was two minutes and forty seconds in length, and participants were required to listen to it only once. Along with this practice imagery audio file, participants in the meditation condition were sent a second file, which was five minutes and twenty-six seconds in length and contained a present-focused stress meditation practice (Appendix K). Participants in the mental imagery condition received an audio file that was nine minutes and fifteen seconds in length, which contained a future-oriented mental imagery practice designed to prompt an image of future self at the end of the academic semester from a third and a first-person perspective (Appendix L). Participants in both conditions were required to listen to their second audio file (i.e., stress meditation or mental imagery) twice per week for four consecutive weeks. New participant “batches” (i.e., students who signed up or who completed the Time 0 questionnaire on the same day) were sent the Time 0 questionnaire (when newly signed

up) in the evening at around 7-9 pm, while audio files (when completed Time 0 questionnaire) were sent at around 8-9am. This schedule was used consistently for all participants.

At the same time as they received the audio files, and every subsequent week for the duration of the experiment (i.e., four weeks), participants were sent a small questionnaire asking them to create an implementation intention (Gollwitzer, 1999) about where and when they planned on listening to their main (second) audio file for the week (Appendix M). This weekly implementation intention was designed to enhance compliance. Two days and four days after receiving their weekly implementation intention, participants were also sent a short manipulation check questionnaire asking them to indicate where and when they had listened to their main audio file (Appendix N).

Two weeks into the experiment, participants were sent the same questionnaire battery as in Time 0. This questionnaire was sent in place of the second reminder for the second week (four days after the second implementation intention questionnaire). This Time 1 questionnaire battery was administered to assess change in empathy, vividness, and emotion for future self, procrastination behaviour and future self-continuity halfway through participants' mental imagery practice (experimental) or stress meditation practice (control).

Finally, two days after their last manipulation check questionnaire (and six days after the fourth implementation intention questionnaire), participants were sent a Time 2 questionnaire battery, which once again contained the exact same measures as the Time 0 and Time 1 questionnaire batteries. The only difference between the Time 0/Time 1 and the Time 2 questionnaire batteries is that the Time 2 questionnaire included a debriefing

form for the experimental (Appendix O) and the control (Appendix P) conditions. The Time 2 assessment was designed to determine if the intervention was successful at increasing emotions, empathy, and vividness of future self, future self-continuity, and at reducing academic procrastination behaviours over the month.

All questionnaires (including implementation and manipulation checks) were linked through the online survey tool Qualtrics. Qualtrics employs multiple layers of security to make sure that data remains private and secure. All surveys created are placed in a Secure Survey Environment (SSE) and the web pages are encrypted with secure socket layer (SSL). Only persons with authorized access to a survey account can download the data from this server. Qualtrics is SAS 70 certified and meets the rigorous privacy standards imposed on health care records by the Health Insurance Portability and Accountability Act (HIPAA). All Qualtrics accounts are protected by password-access, and Qualtrics employees will not access the protected accounts without express permission by the account owner. Responses collected will be anonymous. In addition, IP address collection will be removed from the options when creating the online survey. At the end of the survey, the participants will be encouraged to close the browser window with the following message: “For maximum confidentiality, please close this window.”

The Qualtrics server is located in the U.S. The United States Patriot Act permits U.S. law enforcement officials, for the purpose of an anti-terrorism investigation, to seek a court order that allows access to the personal records of any person without that person's knowledge. Participants will be informed of this on the consent form.

The data collected remained on the Qualtrics account until the end of the study and was then deleted. No backups were kept on the Qualtrics server after the deletion was

processed. In addition, the data were downloaded upon completion of the study and stored on my password protected laptop computer. Data may be shared with trusted colleagues and with requests from competent professionals (APA guidelines 8.14).

Audio scripts: Development and rationale

Practice mental imagery script (all conditions). The practice mental imagery script was designed to familiarize and teach participants in each condition how to properly relax before entering mental imagery (i.e., “Count to ten as you inhale slowly. Starting from your belly, guide your breath up through your ribs and slowly make your way to your chest”), as this has been found to be a crucial step for the experience of vivid imagery (Bakan, 1980; Gendlin, 1981). The script contains a mental imagery scenario involving an apple, where participants are asked to imagine seeing, cutting, smelling, and tasting the apple. This script was inspired by Cautela and McCullough’s (1978) advice for multimodal imagery training:

Vividness must not be equated with solely visual imagery, for the greatest effectiveness is obtained when the client reports vividness in all sense modalities. For example, if a client had trouble imagining or visualizing an airplane, the sound of the plane would be described, the kinaesthetic feeling of the take-off or the seatbelt, the physiological responses such as increased heartbeat or shortness of breath, and the appropriate affective state such as anxiety or exhilaration. It is emphasized that the client not simply imagine the scene, but try to feel that he is actually experiencing it (p.236).

Meditation script (control). The control group audio script was recorded verbatim from David Harshada Wagner’s five-minute stress relieving meditation practice. David is a meditation teacher and transformational guide classically trained in the Indian wisdom

traditions of Yoga, Bhakti, Vedanta, and Tantric Shaivism. He is the founder of Living Meditation Inc. in the United States and of Adhishtana Living in Mumbai, India.

I chose this specific meditation because it requires participants to ground themselves in the present moment. They are asked to scan their bodies and to become familiar with their breath. Since the experimental condition requires participants to project and travel into their future self, I believed that the control group should stay in the present moment in order to be an appropriate contrast to the experimental condition.

I also believed that this specific meditation was appropriate because it uses mental imagery throughout, such as imagining stress inside one's body, and to feel and see energy flowing through the body³. It is important for participants in the control condition to also be subjected to some aspects of mental imagery in order to keep this property of the intervention as consistent as possible for all participants. By doing this, I aimed to experimentally manipulate the specific nature of the mental imagery, such that participants in the control condition were exposed to a present-focused, abstract feeling imagery as opposed to a future self-oriented and multisensory imagery as were participants in the experimental condition.

Mental imagery script (experimental). For the experimental condition, I wrote the script myself, but was influenced by the works of Samuel and Samuel (1975), Samuel and Bennet (1974), and Oneirotherapies (Much & Sheikh, 2002). Oneirotherapy conceptualizes the imagined self as the experiencing of the body with the feelings and sensations accompanying it. As such, I based the future self imagery script on this

³ It is important to remember that mental imagery is not solely visual, but involves all sensory modalities.

principal in order to create an imagery experience that would stimulate a life-like experience, including smells, sights, touch, and the overall feeling of being in future self's body.

Samuel and Samuel (1975), and Samuel and Bennett (1974) have done extensive empirical work on mental imagery and have developed scripts to help individuals get in touch with their selves to stimulate emotion and connect mind and body. As such, my writing was inspired by their "visualization of other persons" and their "visualizing one's self" techniques (Kruck, 2002). In these techniques, these authors recommend bringing attention to facial features and body posture.

Importantly, I specifically designed the experimental script to help participants slowly create and improve their mental image of future self at the end of the academic semester. Concerning the creation of the mental image, I really wanted to leave it up to participants' imagination because I believe that, for this initial exploration of the influence of mental imagery on procrastination, we should assist but not impose an image. As such, I chose to give participants imaginative freedom where I could explore if connecting to future self in *any* way (positive or negative) could increase future self-continuity through empathy and vivid imagery. As such, I wrote the script in a way that gave room for participants to either create a positive or a negative image of future self (i.e., they could project themselves into the future as a procrastinator or as someone that did not procrastinate). To create a felt reality, I made sure to highlight important parts of the end of the semester, such as a high workload in a short amount of time, the end of school, and the start of summer projects. I also wrote in a lot of question prompts. If I painted the picture of many textbooks scattered around future self, then I would ask:

“when you flip through the pages of the books, are these highlighted or do they look brand new?” To help participants create a vivid image, I really do believe that question prompts are very important, as they allow one’s imagination to fill in the details in a way that is very personal and thus, emotionally relevant.

The script was also written so that participants can “see” future self from a third person perspective and also to experience future self through a first-person perspective. I believe that creating a conceptual and phenomenological experience of future self would help participants feel the reality of the end of the semester in a more rich and complex way.

Recording of the practice imagery, experimental, and control scripts. Both the practice imagery script and the experimental script were professionally recorded through the service of voice123.com. As such, I chose to hire Steve Van Beckum because his voice is warm and relaxing, which is important for building a clear mental image. Ultimately, hiring Mr. Van Beckum assured that the scripts were read clearly, and with the appropriate emotions and intonations. Since David Harshada Wagner is a professional and has lead many guided meditations, I believe that using the recording of his stress meditation practice was appropriate for the control condition and would allow participants to adequately relax and focus on present self.

Results

Statistical analyses

All statistical analyses were completed using the SPSS version 22 and SAS version 9.3 statistical packages.

Data cleaning

Screening of outliers, normality in all levels and combinations of relevant variables and tests of homogeneity of variance of residuals were conducted in SPSS (as opposed to SAS) for ease of manoeuvring. All variables and residuals were normally distributed in both the mental imagery and meditation conditions. Participant ID 54 and 121 both appeared as outliers on three variables (52 = T1 Future self-continuity, T1 and T2 Vividness of future self, T1 and T2 Positive emotions for future self; 121 = T2 Future self-continuity, T2 Vividness of future self, T1 trait Empathic concern). There were no significant differences in results when analyses were run without these outliers. As such, these two participants were kept in the final sample.

Hypotheses 1a and 1b

With longitudinal data, I was faced with a few statistical options in order to determine if the mental imagery intervention effect was significantly different from the meditation effect at Time 2. Randomized clinical trials often use three methods if participants are fully randomly assigned to all conditions: a simple comparison of post-test means, a change score method by subtracting post-test from pre-test scores, which tests the same assumptions as a repeated measures ANOVA, or an ANCOVA controlling for pre-test/baseline scores (e.g., Knapp & Schafer, 2009; Allison, 1990). The question of which method is the most adequate has received quite a lot of attention and controversy (e.g., Lord, 1967; Senn, 2006). Although no one method is better than the other, the choice of which to use should be based on the nature of one's data and the question to be

answered (i.e., under certain circumstances, adjusting for pre-test differences may not make any sense, mostly in non-experimental studies, such as treating men and women's weight as equal; see Lord's paradox, Lord, 1967).

As such, I decided to adopt the ANCOVA method for a few reasons. Firstly, although my participants were randomly assigned to both conditions, the mental imagery and meditation group means nonetheless slightly differed at Time 0 (pre-test) on almost all variables (see Table 1). Controlling for pre-test differences by including these scores as covariates increased power and precision and made theoretical sense under the assumption that my sample was representative of the same population (i.e., all participants in my study are normally distributed around the same population mean for each variable).

Secondly, I computed change scores for all variables that I expected to change through time due to the experiment (i.e., Future self-continuity, Positive emotions for future self, Negative emotions for future self, Vividness of future self, Procrastination, Affective empathy for future self) and correlated them with their pre-test scores. All change scores were negatively correlated with pre-test scores (see Table 2, Table 3, and Table 4), which means that an analysis using change scores would underestimate the effect of condition on the chosen outcome variable (Vickers & Altman, 2001). Lastly, I expected the mental imagery condition's rate of growth in Affective empathy for future self, Positive and Negative emotions for future self, Vividness of future self, Future self-continuity, and Procrastination to be different from the meditation condition. However, a change score method would not have allowed me to observed differences in the rate of growth for each of these variables across conditions.

Table 1.
Means and Standard Deviations for all variables.

	Scale	Condition	Time 0	Time 1	Time 2	Condition mean (SD)	Grand mean (SD)
FSC	1-7	Imagery	4.70(1.44)	4.99(1.16)	5.65(.94)	5.12(.100)	4.96(1.10)
		Meditation	4.32(1.63)	4.68(1.30)	5.21(1.32)	4.80(1.20)	
		Sample mean(SD)	4.50(1.55)	4.83(1.24)	5.43(1.17)		
FSVivid	1-5	Imagery	3.13(1.12)	3.60(.86)	3.96(.83)	3.56(.75)	3.46(.81)
		Meditation	3.03(1.25)	3.36(1.05)	3.79(.81)	3.36(.86)	
		Sample mean(SD)	3.08(1.19)	3.48(.96)	3.87(.82)		
FSPA	1-4	Imagery	4.94(1.16)	4.89(1.14)	5.27(1.18)	5.04(.93)	4.89(1.04)
		Meditation	4.72(1.20)	4.74(1.17)	4.92(1.31)	4.72(1.14)	
		Sample mean(SD)	4.82(1.18)	4.82(1.15)	5.09(1.25)		
FSNA	1-4	Imagery	2.49(1.35)	2.37(1.16)	2.36(1.35)	2.42(1.19)	2.49(1.09)
		Meditation	2.75(1.31)	2.45(1.13)	2.51(1.18)	2.57(.98)	
		Sample mean(SD)	2.63(1.33)	2.41(1.14)	4.89(1.04)		
FSEmp	1-6	Imagery	4.24(1.47)	4.38(1.48)	4.82(1.44)	4.44(1.25)	4.32(1.33)
		Meditation	4.19(1.52)	4.18(1.63)	4.39(1.61)	4.20(1.40)	
		Sample mean(SD)	4.21(1.50)	4.28(1.56)	4.60(1.54)		
EmpEC	1-5	Imagery	3.91(.70)	3.89(.62)	3.97(.61)	3.90(.60)	3.88(.60)
		Meditation	3.78(.70)	3.87(.67)	3.81(.71)	3.87(.62)	
		Sample mean(SD)	3.84(.70)	3.88(.64)	3.88(.70)		
EmpPT	1-5	Imagery	3.61(.72)	3.77(.72)	3.88(.71)	3.80(.65)	3.65(.63)
		Meditation	3.44(.64)	3.53(.64)	3.49(.65)	3.50(.57)	
		Sample mean(SD)	3.52(.68)	3.65(.70)	3.68(.70)		
VMI	1-5	Imagery	3.65(.78)	3.65(.78)	4.14(.73)	3.87(.66)	3.84(.64)
		Meditation	3.67(.76)	3.75(.65)	3.97(.70)	3.80(.61)	
		Sample mean(SD)	3.66(.76)	3.79(.70)	4.05(.71)		
Proc	1-6	Imagery	2.94(1.04)	2.78(.96)	2.68(.91)	2.73(.86)	2.76(.85)
		Meditation	2.96(.10)	2.79(.93)	2.81(.95)	2.80(.85)	
		Sample mean(SD)	2.95(1.01)	2.78(.94)	2.74(.93)		

Note. FSC = Future self-continuity, FSVivid = Vividness of future self, FSEmp = Affective empathy for future self, EmpEC = Trait empathetic concern, EmpPT = Trait perspective taking, VMI = Trait vividness of mental imagery, Proc = Total procrastination.

For these reasons, I decided to adopt the ANCOVA method. With these analyses, I could answer the question: are there significant mean differences between the mental imagery and meditation conditions at Time 2 when adjusting for Time 0 differences? To answer the rate of growth question, I decided to use a latent growth curve multilevel modeling approach, as I describe in the exploratory analyses section.

Since ANCOVA is exactly the same as a regression analysis with a categorical predictor and a continuous covariate, I opted to run these analyses using hierarchical linear regressions. I made this decision because I prefer to report R^2 for effect size, as percentage of variance accounted for is easily visualized and prepares one well for the understanding of multilevel models (where error variance becomes an area of interest).

To answer hypothesis 1a, Time 0 Future self-continuity was entered in the first step of a hierarchical linear regression predicting Time 2 Future self-continuity, while the condition variable *ImaMedi* was entered in a second step (see Table 5). When controlling for group differences in Future self-continuity means at Time 0, the mental imagery condition had a Future self-continuity mean at Time 2 that was significantly higher than the meditation condition, $\beta = -.150$; $t(154) = -2.095$. These results indicate that the experimental manipulation was successful at increasing the distance between the mental imagery condition's Future self-continuity mean from the meditation condition's mean at Time 2.

A series of hierarchical linear regressions were conducted in the same fashion to predict each Vividness of future self, Affective empathy for future self, trait Vividness of imagery, trait Empathic concern, trait Empathic perspective taking and Procrastination at Time 2, where the Time 0 version of each variable was entered in the first step and

ImaMedi in the second step (see Table 5). Although results showed no significant mean differences between variables of main interest at Time 2, the hierarchical linear regression predicting Time 2 trait Empathic perspective taking demonstrated that the mental imagery condition had a significantly higher mean than the meditation condition at Time 2 when controlling for Time 0 trait Empathic perspective taking, $\beta = -.161$; $t(151) = -3.109$.

Table 2.
Pearson correlation matrix among Change scores and Time 0 variables for the total sample.

Variables	1	2	3	4	5	6	7
1. ChFSC	-						
2. ChFSVivid	.34**	-					
3. ChFSEmp	.12	.12	-				
4. ChProc	-.17*	.00	-.05	-			
5. T0FSC	-.70**	-.24**	.05	.16	-		
6. T0FSVivid	-.20*	-.75**	-.02	.05	.36**	-	
7. T0FSEmp	.01	-.11	-.40**	-.03	.17*	.25**	-
8. T0Proc	.14	.19*	-.04	-.43**	-.24**	-.22**	.02

Note. ** $p < .01$. * $p < .05$. ChFSC = T2 – T0 Future self-continuity, ChFSVivid = T2 – T0 Vividness of future self, ChFSEmp = T2 – T0 Affective empathy for future self, ChProc = T2 – T0 Total Procrastination.

Table 3.

Pearson correlation matrix among change scores and Time 0 variables for the meditation condition.

Variables	1	2	3	4	5	6	7
1. ChFSC	-						
2. ChFSVivid	.41**	-					
3. ChFSEmp	.15	-.03	-				
4. ChProc	-.17	-.12	-.02	-			
5. T0FSC	-.64**	-.29**	.01	.02	-		
6. T0FSVivid	-.29**	-.78**	.08	.14	.37**	-	
7. T0FSEmp	.01	-.10	-.36**	-.16	.16	.24*	-
8. T0Proc	.15	.28*	.00	-.41**	-.24**	-.30**	.09

Note. ** $p < .01$. * $p < .05$. ChFSC = T2 – T0 Future self-continuity, ChFSVivid = T2 – T0 Vividness of future self, ChFSEmp = T2 – T0 Affective empathy for future self, ChProc = T2 – T0 Total Procrastination.

Table 4.

Pearson correlation matrix among change scores and Time 0 variables for the mental imagery condition.

Variables	1	2	3	4	5	6	7
1. ChFSC	-						
2. ChFSVivid	.26*	-					
3. ChFSEmp	.07	.29*	-				
4. ChProc	-.17	.12	-.06	-			
5. T0FSC	-.80**	-.17	-.01	.30*	-		
6. T0FSVivid	-.09	-.72**	-.14	-.02	.35**	-	
7. T0FSEmp	.00	-.12	-.46**	.10	.18	.25*	-
8. T0Proc	.12	.08	-.08	-.46**	-.24*	-.14	-.04

Note. ** $p < .01$. * $p < .05$. ChFSC = T2 – T0 Future self-continuity, ChFSVivid = T2 – T0 Vividness of future self, ChFSEmp = T2 – T0 Affective empathy for future self, ChProc = T2 – T0 Total Procrastination.

These results indicate that the experimental manipulation increased trait Empathic perspective taking, not for future self, but in general. This was surprising because trait Empathic perspective taking was included in the study as a trait control variable and was expected to stay fairly stable over time for all participants. However, participants in the mental imagery condition were required to listen to a recording that allowed them to practice and develop perspective taking by imagining future self from a first and a third-person perspective. Although I expected the mental imagery intervention to mostly foster affective empathy, it seems like it was successful at developing this cognitive side of empathy over and above the meditation condition.

Hypothesis 2

I had initially decided to adopt Hayes and Preacher's (2014) *MEDIATE* macro for SPSS to determine if mean differences in T1 Positive emotions for future self, Affective empathy for future self, and Vividness of future self between the mental imagery and meditation conditions could significantly explain mean differences in T2 Future self-continuity, also between these two conditions. Such a mediation model was created to explore the affective and cognitive mechanisms fostered by the mental imagery condition that could then be used to connect to future self. However, this initial model could not be fully carried out as planned.

Firstly, I decided to remove Positive emotions for future self from the model because it was very highly correlated with Affective empathy for future self at all time points (see Table 6). Since these two variables share half of their variance, I would be at risk for suppression effects. The argument could also be made that the high correlations

Table 5.

Unstandardized Regression Coefficients (Standard Error), 95% CI, and Effect Sizes for condition (ImaMedi) and Time 0 covariates predicting Time 2 variables.

Time 0	B(SE)	<i>p</i>	Lower Bound	Upper Bound	Step 1 <i>R</i> ²	Step 2 ΔR^2	Time 2 outcome
Constant	3.9(.26)	.000	3.40	4.44			
FSC	.33(.05)	.000	.22	.43	.192**	-	FSC
ImaMedi	-.35(.16)	.038	-.68	-.02	-	.02*	
Constant	3.02(.17)	.000	2.70	3.36			
FSVivid	.27(.05)	.000	.17	.37	.153**	-	FSVivid
ImaMedi	-.12(.12)	.323	-.36	.12	-	.98	
Constant	1.92(.28)	.000	1.35	2.50			
FSEmp	.64(.06)	.000	.51	.77	.390**	-	FSEmp
ImaMedi	-.20(.19)	.283	-.58	.17	-	.00	
Constant	1.10(.33)	.000	1.33	2.65			
FSPA	.65(.06)	.000	.52	.78	.392**	-	FSPA
ImaMedi	-.22(.15)	.168	-.53	.09	-	.01	
Constant	.73(.17)	.000	.38	1.07	.447**	-	
FSNA	.65(.06)	.060	.53	.76	-	.00	FSNA
ImaMedi	-.02(.16)	.886	-.33	.28			
Constant	2.05(.22)	.000	1.61	2.50			
VMI	.55(.06)	.000	.43	.66	.356**	-	VMI
ImaMedi	-.13(.09)	.155	-.31	.05	-	.01	
Constant	1.30(.22)	.000	.86	1.72			
EmpEC	.68(.06)	.000	.57	.78	.489**	-	EmpEC
ImaMedi	-.10(.08)	.208	-.25	.05	-	.00	
Constant	1.07(.20)	.000	.70	1.44			
EmpPT	.74(.05)	.000	.64	.85	.58**	-	EmpPT
ImaMedi	-.23(.07)	.002	-.37	-.08	-	.03*	
Constant	.72(.16)	.000	.41	1.04			
Proc	.70(.05)	.000	.60	.80	.54**	-	Proc
ImaMedi	.08(.10)	.447	-.13	.28	-	.00	

Note. ImaMedi = mental imagery contrast-coded .5 and meditation contrast-coded -.5 (Intercept represents outcome mean pooling over conditions, ImaMedi represents mean difference between conditions), FSC = Future self-continuity, FSVivid = Vividness of future self, FSEmp = Affective empathy for future self, EmpEC = Trait empathetic concern, EmpPT = Trait perspective taking, ImaVivid = Trait vividness of mental imagery, Proc = Total procrastination.

**p* < .05 ** *p* < .01

between affective empathy and positive discrete emotions for future self indicate that these variables are two parts of the same construct. As a precaution, only the most theoretically relevant of the two should be kept for the present analyses. Based on this information, I decided to keep Affective empathy for future self because the central theoretical and empirical goal of this thesis is to explore how cognitive and affective processes that allow us to connect to others, such as empathy, may also allow us to connect to future self.

Secondly, the regression analyses for hypotheses 1a and 1b demonstrated that both the mental imagery and meditation condition means did not significantly differ at Time 2 for Vividness of future self and Affective empathy for future self. Because of this, the main question at the heart of this mediation model could not be answered. Instead, I decided to adopt a more general question to explore the mechanisms involved in our connection to future self: can affective empathy for future self mediate the relation between vividness of future self and future self-continuity?

This question was initially developed following three correlational studies demonstrating that trait Vividness of mental imagery significantly positively predicted Positive affective states (Blouin-Hudon & Pychyl, 2015). Interestingly, Vividness of mental imagery only positively predicted Future self-continuity in ten years and in two months when entered as a single predictor in a hierarchical linear regression. Once entered in the model, Positive affect became the only significant predictor of Future self-continuity. This suggests that affective processes such as Affective empathy for future self may mediate the relation between Vividness of future self and Future self-continuity. In fact, the literatures reviewed in the introduction provided sufficient evidence for

exploring the tenability of such a mediation model in the context of the present experiment by demonstrating the efficiency with which vivid mental images can stimulate affect (Kosslyn, Ganis, & Thompson, 2001; Damasio, 1999; Holmes et al., 2006; Holmes et al., 2008; Blair, Ma, & Lenton, 2001), and the connection to others fostered by affective processes such as empathy (Cwir, Carr, Walton, & Spencer, 2011; Cialdini, Brown, Lewis, et al., 1997). Before moving on to this model however, I wanted to explore if Affective empathy for future self might be more adequately conceptualized as a moderator of Future self-continuity growth through time alongside Vividness of future self. As such, I describe the mediation model after I elaborate on the Future self-continuity growth hypotheses in the exploratory analyses section.

Table 6.
Pearson correlation matrix among FSEmp and FSPA at all time points.

Variables	T0FSEmp	T1FSEmp	T2FSEmp
T0FSPA	.61**	.54**	.47**
T1FSPA	.56**	.71**	.60**
T2FSPA	.52**	.62**	.74**

Note. ** $p < .01$. * $p < .05$. T0 = Time 0, T1 = Time 1, T2 = Time 2, FSEmp = Affective empathy for future self, FSPA = Positive emotions for future self.

Hypothesis 3

To determine if Time 2 Future self-continuity significantly predicted decreases in Time 2 Procrastination, Time 2 Future self-continuity and the condition variable ImaMedi were entered in the first step of a hierarchical linear regression, while the interaction between Time 2 Future self-continuity and ImaMedi was entered in the second step. The main effect of Time 2 Future self-continuity significantly predicted

decreases in Time 2 Procrastination, $\beta = -.150$; $t(154) = -2.095$ (see Table 7). These results offer evidence for the idea that people who feel *generally* more connected to their future self at the end of the semester also procrastinate less. Unfortunately, since the interaction between ImaMedi and Time 2 Future self-continuity was not significant, I cannot conclude that, due to their higher Future self-continuity mean, participants in the mental imagery condition procrastinated less than participants in the meditation condition.

The analyses reviewed so far help us understand the differences (and similarities) in affective and cognitive processes that may have been fostered by listening to a mental imagery or a meditation audio recording for the duration of 4 weeks. Because change scores would have underestimated the effects of interest, I was highly restricted in my ability to explore how Future self-continuity, Vividness of future self, Affective empathy for future self, and Procrastination unfolded through time for the mental imagery condition, the meditation condition, and for the overall sample. Is there significant change in Future self-continuity, Vividness of future self, Affective empathy for future self, and Procrastination over time? Do participants in the mental imagery condition experience different rates of change for these variables over time than the meditation condition? Can Vividness of future self and Affective empathy for future self predict the rate of change in Future self-continuity for either condition or both conditions? Similarly, can Future self-continuity predict the rate of change in Procrastination? Finally, do individuals differ from themselves and/or from other people in their rate of change for these variables at a particular point in time or on average?

Table 7.

Unstandardized Regression Coefficients (Standard Error), 95% CI, and Effect Sizes for Time 2 FSC, condition (ImaMedi) and their interaction predicting Time 2 Proc.

95.0% CI						
	B(SE)	p	Lower Bound	Upper Bound	Step 1 R^2	Step 2 ΔR^2
Constant	3.752	.000	2.920	4.585		
T2FSC	-.132(.078)	.022	-.337	-.027	.038*	-
ImaMedi	-.606(.769)	.769			-	-
FSCXImaMedi	.100(.137)	.467	-.171	.371	-	.003

Note. ImaMedi was dummy coded 0 for meditation 1 for mental imagery. T2FSC = Time 2 Future self-continuity.

As mentioned earlier, to explore these more fine-grained questions, I decided to adopt a latent growth curve multilevel model statistical technique, which I have conducted in SAS version 9.3. In the next section, I elaborate on my reasons for choosing this technique and present equations, tables, figures, and syntax to help clarify my interpretations of the results.

Exploratory analyses: Latent growth curve multilevel models

The traditional repeated measures ANOVA assumes that intervals between time points are equally spaced (which is true for the present study), that the number of participants in all groups are equal, that there are no missing data, and that the variance-covariance matrix of the dependant variable is compound symmetric (i.e., all variances are equal at all time points and all covariances are equal between time points). On the contrary, the latent growth curve multilevel analyses assume that the random (residual) effects are heteroschedastic over time points (i.e., that people may vary from themselves or others over time). By modeling such residual variance, this approach allows for the

estimation of inter-individual variability and intra-individual patterns of change over time (Hoffman & Stawski, 2009). More specifically, this technique allowed me to model time as a continuous variable. This is appropriate for the present experiment because not only am I interested to see why participants differed from others on average over time, I am also very interested in seeing how participants differed from their own average rate of change at any particular point in time (Hoffman, 2007). This second point is particularly important because the experiment was designed in hopes of having an effect at a very personal level. As I have explained in the rationale for the audio recordings, participants were left with some imaginative freedom to connect to future self. As such, any change experienced at the personal level at each time point is of interest for the goals of this study.

Change across time

The first series of models that I present were created to answer the question: did Future self-continuity, Vividness of future self, Affective empathy for future self, trait Empathic perspective taking, trait Empathic concern, trait Vividness of mental imagery, and Procrastination change significantly across time? It is important to note that the Future self-continuity and Procrastination as outcome analyses involved multiple models and predictors of growth (Singer & Willett, 2003; Kwok, Underhill, Berry, et al., 2008). As such, I elaborate on these predictors in further detail in their appropriate sections (Jackson, 2010). For this section, however, I focus on time as the sole predictor of all variables. See Appendix Q for the full SAS syntax used for all exploratory analyses.

Table 8.

Parameter Estimates (PE), Standard Error (SE), t-tests (t), and significance estimates (p) for Vividness of future self growth through time by condition.

Model		PE	SE	t	p
A	γ_{00}	3.08	.08	37.6	<.000
	$\gamma_{01ImaMedi}$	-.12	.16	-.72	.472
	γ_{10time}	.40	.04	9.0	<.000
	$\gamma_{11timeXImaMedi}$	-.02	.09	-.30	.775
	τ_{00}	.90	.14	6.40	<.000
	τ_{11time}	.11	.05	2.30	.011
	τ_{10cov}	-.26	.07	-4.00	.000
	σ^2_{resid}	.46	.05	8.51	<.000

Note. ImaMedi = mental imagery contrast-coded .5 and meditation contrast-coded -.5, FSVivid = Vividness of future self.

The models for Vividness of future self (Table 8), Affective empathy for future self (Table 9), VMI (Table 10), Empathic perspective taking (Table 11), Future self-continuity (Table 12; model B), and Procrastination (Table 13; model B) all demonstrate that there was significant and systematic change in these variables over time. Although negative emotions for future self were not included in these analyses, it is important to mention that these did not significantly change over time (refer to Table 1 for means). Only trait Empathic concern did not change over time on average (Table 14). These results are demonstrated by the fixed effect for the time slope (γ_{10time}). To explore if people deviated/varied from the average baseline score and average rate of change, the intercept and the time slope were left to vary randomly (Singer, 1998). This is represented by the following equation:

$$\text{Level-1: } y_{ti} = \beta_{0i} + \beta_{1i}Time_{ti} + r_{ti}$$

$$\text{Level-2: } \beta_{0i} = \gamma_{00} + \mu_{0i}$$

$$\beta_{1i} = \gamma_{10} + \mu_{1i}$$

Reduced form:

$$y_{ti} = \gamma_{00} + \gamma_{10}time_{ti} + \mu_{0i} + \mu_{1i}Time_{ti} + r_{ti}$$

The symbols (μ_{0i}) and (μ_{1i}) represent the residuals or random effects for the intercept and the time slope, respectively, and demonstrate if participants varied around the average intercept and rate of change across time. Finally, the within-person residual (r_{ij}) represents how much a person has deviated from their *own* pattern of change at each time point. In the tables listed above, the variance-covariance for these random effects is represented by (τ_{00}) for the intercept, (τ_{11time}) for the time slope, (τ_{10cov}) for their covariance, and (σ^{2resid}) for the within-person residual. Turning to (τ_{00}) , participants showed significant variability at baseline for Future self-continuity, Vividness of future self, Affective empathy for future self, trait Empathic concern, trait Empathic perspective taking, trait Vividness of imagery, and Procrastination. As would be expected, these results indicate that participants began the experiment with different scores than the average on all variables. Looking at (τ_{11time}) , participants also showed significant variability around the *average* rate of change for Future self-continuity, Vividness of future self, Affective empathy for future self, trait Empathic concern, and trait Vividness of imagery, but not for trait Empathic perspective taking or Procrastination. Although the average rate of change for trait Empathic concern was non-significant, the random variability indicates that certain participants may have nonetheless experienced change from the average non-significant rate of change in empathetic concern through time. This demonstrates that participants did not all follow average patterns of change and provides some initial evidence that the experiment may have been successful at letting

participants' imagination roam semi-freely to forge a personalized image and empathic connection to future self.

Table 9.

Parameter Estimates (PE), Standard Error (SE), t-tests (t), and significance estimates (p) for Affective empathy for future self growth through time by condition.

Model		PE	SE	t	p
A	γ_{00}	4.20	.11	38.00	<.000
	$\gamma_{01\text{ImaMedi}}$	-.05	.22	-.23	.817
	$\gamma_{10\text{time}}$	.22	.05	4.25	<.000
	$\gamma_{11\text{timeXImaMedi}}$	-.11	.10	-1.12	.262
	τ_{00}	2.00	.25	7.42	<.000
	$\tau_{11\text{time}}$	.14	.06	2.51	.006
	$\tau_{10\text{cov}}$	-.12	.09	-1.34	.180
	$\sigma^{2\text{resid}}$	.54	.06	8.50	<.000

Note. ImaMedi = mental imagery contrast-coded .5 and meditation contrast-coded -.5, FSEmp = Affective empathy for future self.

The significant covariance estimates between the intercept and the time slope for Future self-continuity, Vividness of future self, and trait Vividness of imagery indicate that baseline scores on these variables significantly influenced their rate of change through time. Since these estimates are all negative, results demonstrate that participants who have *lower* baseline scores on Future self-continuity, Vividness of future self, and trait Vividness of imagery experience *steeper* rates of change over time than participants who have higher baseline scores on these variables.

Finally, the significant ($\sigma^{2\text{resid}}$) for Future self-continuity, Vividness of future self, Affective empathy for future self, trait Empathic concern, trait Empathic perspective taking, trait Vividness of imagery, and Procrastination indicates that participants deviated from their *own* pattern of change at each time point on all variables. Once again, while the average rate of change for trait Empathic concern was non-significant, within-person

variability indicates that people nonetheless slightly increased from their own average change at each time point. Once more, these results offer evidence that the experiment was successful in one of its main goals by targeting change at a more personal level. Of course, these results are representative of the sample as a whole and leave much to be said about possible differences across conditions.

Table 10.

Parameter Estimates (PE), Standard Error (SE), t-tests (t), and significance estimates (p) for trait Vividness of imagery growth through time by condition.

Model		PE	SE	t	p
A	γ_{00}	3.65	.05	67.33	<.000
	$\gamma_{01}ImaMedi$	.02	.11	.18	.853
	γ_{10time}	.19	.03	7.35	<.000
	$\gamma_{11time \times ImaMedi}$	-.08	.05	-1.57	.117
	τ_{00}	.44	.06	7.46	<.000
	τ_{11time}	.04	.01	3.00	.002
	τ_{10cov}	-.07	.02	-3.00	.004
	σ^2_{resid}	.14	.02	8.30	<.000

Note. ImaMedi = mental imagery contrast-coded .5 and meditation contrast-coded -.5, VMI = Trait vividness of imagery.

Change across time by condition

The condition variable ImaMedi was contrast-coded (mental imagery .5, meditation -.5) and entered in the models for Vividness of future self (Table 8), Affective empathy for future self (Table 9), trait Vividness of imagery (Table 10), trait Empathic perspective taking (Table 11), Future self-continuity (Table 12; model C), and Procrastination (Table 13; model C) as a time-invariant covariate represented by ($\gamma_{01}ImaMedi$). A time-invariant covariate is modeled as a level-2 predictor and is assumed to have a constant value over time. These models are represented by the following equation (other predictors of Future self-continuity and Procrastination have been

removed from this equation for now for ease of interpretation. These appear in later sections):

$$\text{Level-1: } y_{ti} = \beta_{0i} + \beta_{1i}Time_{ti} + r_{ti}$$

$$\text{Level-2: } \beta_{0i} = \gamma_{00} + \gamma_{01}ImaMedi_i + \mu_{0i}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}ImaMedi_i + \mu_{1i}$$

Reduced form:

$$y_{ti} = \gamma_{00} + \gamma_{01}ImaMedi_i + \gamma_{10}Time_{ti} + \gamma_{11}ImaMedi_iTime_{ti} + \mu_{0i} + \mu_{1i}Time_{ti} + r_{ti}$$

The level-2 equation demonstrates that the condition variable *ImaMedi* is predicting both baseline scores (β_{0i}) and why participants experience change over time (β_{1i}). In the reduced form equation, the symbol ($\gamma_{01}ImaMedi_i$) represents the mean difference between the mental imagery and meditation conditions on the outcome variable at Time 0. For the Future self-continuity and Procrastination models, this represents the mean difference between the two conditions at Time 0 while controlling for other predictors included in the models. The symbol ($\gamma_{11}ImaMedi_iTime_{ti}$) represents the cross-level interaction predicting whether individuals experience steeper or flatter rates of change based on their assigned condition.

For these models, results indicate that there were no baseline differences based on condition when controlling for other predictors in the model. Unfortunately, there were also no significant condition differences in rate of change based on condition for almost all variables. Although the mental imagery condition showed a higher Future self-continuity mean at Time 2 than the meditation condition, these results demonstrate that participants in both conditions experienced a very similar rate of change across time such that as the end of term neared, participants felt more connected to future self at the end of

the semester. Participants in both conditions also experienced similar change in the same direction for Vividness of future self, Affective empathy for future self, trait Empathic concern, trait Vividness of imagery, and Procrastination. These results show that for the overall sample, future self became more vivid, Affective empathy for future self increased, and Procrastination was slightly reduced.

Table 11.

Parameter Estimates (PE), Standard Error (SE), t-tests (t), and significance estimates (p) for trait Empathic perspective taking growth through time by condition.

Model		PE	SE	t	p
A	$\gamma_{00intercept}$	3.53	.05	72.30	<.000
	$\gamma_{01ImaMedi}$	-.15	.10	-1.50	.135
	γ_{10time}	.08	.02	4.40	<.000
	$\gamma_{11time \times ImaMedi}$	-.09	.04	-2.50	.014
	$\tau_{00intercept}$	.36	.05	7.42	<.000
	τ_{11time}	.00	.01	.03	.489
	τ_{10cov}	-.00	.01	-.14	.885
	σ^2_{resid}	.11	.01	8.55	<.000

Note. ImaMedi = mental imagery contrast-coded .5 and meditation contrast-coded -.5, EmpPT = Trait perspective taking.

Surprisingly, results indicate a significant difference in the rate of change for trait Empathic perspective taking by condition. Probing of this interaction revealed that participants in the mental imagery condition experienced a steeper rate of change in Empathic perspective taking than the meditation condition (Figure 1). In fact, the meditation condition did not experience significant change across time in trait Empathic perspective taking. Going back to the variance estimate for the time slope (τ_{11time}), these condition differences might explain why trait Empathic perspective taking was one of the only variables for which participants did not significantly vary around the average rate of

change. From this evidence, it is possible to posit that the mental imagery experiment manipulated the variance in trait Empathic perspective taking to the extent that individual variability across time was almost completely replaced by a condition-specific average rate of change. Although trait Empathic perspective taking was included in the study as a control variable, these results and results from hypothesis 1a suggest that its role may be more important than initially anticipated and should be explored further. As such, trait Empathic perspective taking was treated as a predictor of Future self-continuity and Procrastination for the later analyses.

Predictors of Future self-continuity change across time

Results for hypothesis 1a revealed that there were only significant Time 2 mean differences between conditions for Future self-continuity and trait Empathic perspective taking. However, the previous exploratory latent growth curve analyses demonstrated that two variables hypothesized to influence participants' connection to future self—Vividness of future self and Affective empathy for future self—nonetheless demonstrated change across time. Although this change varied across participants, as indicated by the ($\tau_{11\text{time}}$) variance estimates, these results nonetheless indicate that change in Future self-continuity may be influenced by change in Vividness of future self and Affective empathy for future self. As reported in the previous section, change in trait Empathic perspective taking varied by condition. Since Future self-continuity did not show a different rate of change by condition but revealed a significant mean difference at Time 2, two possible scenarios may arise: 1) Vividness of future self and Affective empathy for future self are direct predictors of change in Future self-continuity, which would be consistent with the

Table 12.

Parameter Estimates (PE), Standard Error (SE), t-tests (t), and significance estimates (p) for Vividness of future self, Affective empathy for future self, and trait Empathic perspective taking predicting Future self-continuity.

Model		PE	SE	t	p
A	γ_{00}	4.70	.94	47.52	<.000
	γ_{10time}	.43	.05	8.23	<.000
	$\tau_{00intercept}$	1.00	.13	6.74	<.000
	σ^2_{resid}	.93	.07	12.44	<.000
B	γ_{00}	4.46	.10	42.24	<.000
	γ_{10time}	.44	.06	8.00	<.000
	$\tau_{00intercept}$	1.52	.23	6.56	<.000
	τ_{11time}	.20	.08	2.43	.007
	τ_{10cov}	-.40	.11	-3.56	.000
	σ^2_{resid}	.73	.08	8.54	<.000
C	$\gamma_{00intercept}$	4.15	.53	7.75	<.000
	$\gamma_{01ImaMedi}$	-.30	.20	-1.40	.162
	$\gamma_{02EmpEC}$	.09	.10	.86	.388
	γ_{03VMI}	.02	.09	.21	.836
	$\gamma_{04mFSVivid}$	.60	.12	5.00	<.000
	$\gamma_{05mEmpPT}$	-.15	.16	-.91	.362
	$\gamma_{06mFSEmp}$	.12	.07	1.50	.136
	γ_{10time}	.24	.06	3.61	.000
	$\gamma_{20FSVividpc}$	.21	.12	1.67	.096
	$\gamma_{30EmpPTpc}$	.73	.30	2.50	.013
	$\gamma_{40FSEmppc}$	-.15	.12	-1.30	.207
	$\gamma_{11timeXImaMedi}$	-.00	.13	-.00	.997
	$\gamma_{14timeXmFSVivid}$	.06	.07	1.00	.331
	$\gamma_{15timeXmEmpPT}$	.07	.08	1.00	.354
	$\gamma_{16timeXmFSEmp}$	-.03	.04	-.80	.422
	$\gamma_{21FSVividpcXtime}$	.20	.10	2.01	.045
	$\gamma_{31EmpPTpcXtime}$	-.62	.23	-2.70	.007
	$\gamma_{41FSEmppcXtime}$	.20	.09	2.21	.028
	$\gamma_{21FSVividpcXImaMedi}$	.02	.17	.12	.905
	$\gamma_{31EmpPTpcXImaMedi}$	.13	.31	.44	.663
	$\gamma_{41FSEmppcXImaMedi}$	.10	.13	.80	.436
	$\gamma_{14ImaMediXmFSVivid}$	-.06	.17	-.35	.726
	$\gamma_{15ImaMediXmEmpPT}$	-.32	.22	-1.47	.144
	$\gamma_{15ImaMediXmFSEmp}$	.07	.10	.73	.466
	$\tau_{00intercept}$	1.25	.20	6.02	<.000
	τ_{11time}	.20	.08	2.37	.008
	$\tau_{22FSVividpc}$	.33	.13	2.50	.006
	τ_{10cov}	-.40	.11	-3.37	.000
	τ_{20cov}	-.04	.12	-.31	.758
	τ_{12cov}	-.01	.08	-1.20	.230

	σ^{2resid}	.50	.08	6.10	<.000
D	$\gamma_{00intercept}$	4.45	.10	41.30	<.000
	$\gamma_{01ImaMedi}$	-.37	.16	-2.30	.022
	$\gamma_{02mEmpPT}$	.01	.16	.59	.555
	γ_{10time}	.43	.05	7.45	<.000
	$\gamma_{20EmpPTpc}$	.43	.30	1.48	.139
	$\gamma_{21EmpPTpcXtime}$	-.22	.24	-.93	.355
	$\gamma_{12timeXmEmpPT}$	.07	.08	.80	.423
	$\gamma_{21EmpPTpcXImaMedi}$	.12	.31	.37	.711
	$\gamma_{12ImaMediXmEmpPT}$	-.34	.25	-1.35	.178
	$\tau_{00intercept}$	1.50	.23	6.42	<.000
	τ_{11time}	.16	.07	2.20	.014
	τ_{10cov}	-.37	.10	-3.42	.000
	σ^{2resid}	.73	.08	8.42	<.000
E	$\gamma_{00intercept}$	4.15	.41	10.06	<.000
	$\gamma_{01ImaMedi}$	-.37	.15	-2.42	.016
	$\gamma_{02mFSEmp}$	.17	.07	2.27	.024
	$\gamma_{03EmpEC}$	.08	.10	.81	.416
	γ_{10time}	.40	.05	7.05	<.000
	$\gamma_{20FSEmpc}$	-.10	.14	-.75	.453
	$\gamma_{21FSEmpcXtime}$	.19	.10	1.92	.056
	$\gamma_{12timeXmFSEmp}$	.02	.04	.40	.687
	$\gamma_{21FSEmpcXImaMedi}$	.01	.15	.06	.954
	$\gamma_{12ImaMediXmFSEmp}$	.06	.10	.62	.534
	$\tau_{00intercept}$	1.50	.23	6.37	<.000
	τ_{11time}	.15	.07	2.00	.023
	$\tau_{22FSEmpc}$	.19	.11	1.75	.040
	τ_{10cov}	-.38	.11	-3.41	.000
	τ_{20cov}	-.12	.11	-1.05	.292
	τ_{12cov}	-.04	.06	1.75	.040
	σ^{2resid}	.65	.09	7.25	<.000
F	$\gamma_{00intercept}$	4.42	.33	13.33	<.000
	$\gamma_{01ImaMedi}$	-.27	.13	-2.00	.047
	$\gamma_{02mFSVivid}$	.58	.11	5.13	<.000
	γ_{03VMI}	.03	.08	.42	.675
	γ_{10time}	.25	.06	4.15	<.000
	$\gamma_{20FSVividpc}$	.19	.12	1.57	.117
	$\gamma_{21FSVividpcXtime}$	.22	.09	2.40	.017
	$\gamma_{12timeXmFSVivid}$	.10	.06	1.70	.092
	$\gamma_{21FSVividpcXImaMedi}$	.02	.14	.16	.871
	$\gamma_{12ImaMediXmFSVivid}$	-.00	.16	-.02	.984
	$\tau_{00intercept}$	1.30	.21	6.10	<.000
	τ_{11time}	.20	.08	2.40	.008
	$\tau_{22FSVividpc}$	.26	.11	2.31	.010
	τ_{10cov}	-.40	.11	-3.52	.000

τ_{20cov}	-.09	.07	-.24	.230
τ_{12cov}	-.09	.07	-1.20	.229
σ^{2resid}	.52	.08	6.50	<.000

Note. ImaMedi = mental imagery contrast-coded .5 and meditation contrast-coded -.5, FSEmpc/mFSEmp = Affective empathy for future self, EmpPTpc/mEmpPT = Perspective taking, FSVividpc/mFSVivid = Vividness of future self. Model A is unconditional (no predictors) and TIME is fixed. TIME is left to vary randomly in Model B and in all subsequent models. Model C contains all time-variant (level-1; time, FSEmpc, EmpPTpc, FSVividpc) and time-invariant (level-2; ImaMedi, mFSEmp, mEmpPT, mFSVivid) predictors of Future self-continuity (FSC) and their interactions, but only FSVividpc is left to vary randomly. Model D contains only EmpPT predictors, model E FSEmp predictors, and model F FSVivid predictors.

variability in change across participants in all of these variables for the entire sample, or 2) differences in trait Empathic perspective taking by condition are predictive of change in Future self-continuity, which could lead to the conclusion that condition differences in trait Empathic perspective taking across time explain Future self-continuity condition differences at Time 2.

To determine the tenability of these initial scenarios, I created a first unconditional model with a fixed slope for time, which assumes that everyone in the sample changes at the same rate over time. This model includes no additional predictors in order to determine how much variance in Future self-continuity is explained by between-person (level-2) or within-person (level-1) variability (Table 12, model A). To determine this, the inter-class correlation (ICC) was obtained by dividing ($\tau_{00intercept}$) by the sum of ($\tau_{00intercept}$) and (σ^{2resid}). For this model, the ICC is:

$$\begin{aligned} &.899/.899 + .927 = \\ &.899/1.826 = \\ &.492 \end{aligned}$$

This ICC indicates that 49.2% of the total variability in Future self-continuity comes from between-person variability. This suggests that scenario 1, which posits that within-person variability may be more predictive of change in Future self-continuity, and scenario 2,

which posits that between-person variability may be more predictive of change in Future self-continuity, are viable.

Using this evidence as a guide, I created a new model incorporating the within- and between-person decomposition of each Vividness of future self, Affective empathy for future, and trait Empathic perspective taking as well as their interactions with time and the condition variable *ImaMedi* to predict Future self-continuity (Table 12, model C). Consider the following equation for this model:

$$\text{Level-1: } y_{ti} = \beta_{0i} + \beta_{1i}Time_{ti} + \beta_{2i}FSVividpc_{ti} + \beta_{3i}EmpPTpc_{ti} + \beta_{4i}FSEmp_{ti} + \beta_{21i}FSVividpc_{ti}Time_{ti} + \beta_{31i}EmpPTpc_{ti}Time_{ti} + \beta_{41i}FSEmp_{ti}Time_{ti} + r_{ti}$$

$$\text{Level-2: } \beta_{0i} = \gamma_{00} + \gamma_{01}ImaMedi_i + \gamma_{02}VMI_i + \gamma_{03}EmpEC_i + \gamma_{04}mFSVivid_i + \gamma_{05}mEmpPT_i + \gamma_{06}mFSEmp_i + \gamma_{14}ImaMedi_i mFSVivid_i + \gamma_{15}ImaMedi_i mEmpPT_i + \gamma_{16}ImaMedi_i mFSEmp_i + \mu_{0i}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}ImaMedi_i + \gamma_{14}mFSVivid_i + \gamma_{15}mEmpPT_i + \gamma_{16}mFSEmp_i + \mu_{1i}$$

$$\beta_{2i} = \gamma_{20} + \gamma_{21}ImaMedi_i + \mu_{2i}$$

$$\beta_{3i} = \gamma_{30} + \gamma_{31}ImaMedi_i$$

$$\beta_{4i} = \gamma_{40} + \gamma_{41}ImaMedi_i$$

Reduced form:

$$y_{ti} = \gamma_{00} + \gamma_{01}ImaMedi_i + \gamma_{02}VMI_i + \gamma_{03}EmpEC_i + \gamma_{04}mFSVivid_i + \gamma_{05}mEmpPT_i + \gamma_{06}mFSEmp_i + \gamma_{10}time_{ti} + \gamma_{20i}FSVividpc_{ti} + \gamma_{30i}EmpPTpc_{ti} + \gamma_{40i}FSEmp_{ti} + \gamma_{11}Time_{ti}ImaMedi_i + \gamma_{14}Time_{ti}mFSVivid_i + \gamma_{15}Time_{ti}mEmpPT_i + \gamma_{16}Time_{ti}mFSEmp_i + \gamma_{21i}FSVividpc_{ti}Time_{ti} + \gamma_{31i}EmpPTpc_{ti}Time_{ti} + \gamma_{41i}FSEmp_{ti}Time_{ti} + \gamma_{21}FSVividpc_{ti}ImaMedi_i + \gamma_{31}EmpPTpc_{ti}ImaMedi_i + \gamma_{41}FSEmp_{ti}ImaMedi_i + \gamma_{14}ImaMedi_i mFSVivid_i + \gamma_{15}ImaMedi_i mEmpPT_i + \gamma_{16}ImaMedi_i mFSEmp_i + \mu_{0i} + \mu_{1i}time_{ti} + \mu_{2i}FSVividpc_{ti} + r_{ti}$$

Entering the raw Vividness of future self, Affective empathy for future self, and trait Empathic perspective taking variables in the model would have only indicated the total

effect of these variables without informing how much each is predictive of within and/or between variance in Future self-continuity. As such, I decomposed these variables into level-1 predictors to account for within-person variability by centering them around each person's mean for each time point (person-centered or pc; Enders & Tofighi, 2007; Curran & Bauer, 2011). These are denoted in the reduced form equation by $(\gamma_{20i}FSVividpc_{ti})$, $(\gamma_{30i}EmpPTpc_{ti})$, and $(\gamma_{40i}FSEmpc_{ti})$ and represent time-varying covariates, which take on different values over time. Their interaction with $(\gamma_{10i}time_{ti})$ is denoted by $(\gamma_{21i}FSVividpc_{ti}Time_{ti})$, $(\gamma_{31i}EmpPTpc_{ti}Time_{ti})$, and $(\gamma_{41i}FSEmpc_{ti}Time_{ti})$ and were entered in the model to determine if the effect of these predictors on Future self-continuity is stronger or weaker depending on the time point. The interaction terms between these variables and *ImaMedi* were also entered in the model to see if the effects of $(\gamma_{20i}FSVividpc_{ti})$, $(\gamma_{30i}EmpPTpc_{ti})$, and $(\gamma_{40i}FSEmpc_{ti})$ on Future self-continuity at each time point depended on random assignment to either the mental imagery or meditation condition. These terms are denoted in the reduced form equation by $(\gamma_{21i}FSVividpc_{ti}ImaMedi_{ti})$, $(\gamma_{31i}EmpPTpc_{ti}ImaMedi_{ti})$, and $(\gamma_{41i}FSEmpc_{ti}ImaMedi_{ti})$. Finally, the slope for $(\gamma_{20i}FSVividpc_{ti})$ was set to vary randomly by the inclusion of its error term $(\mu_{2i}FSVividpc_{ti})$ in the equation and model. Because this study only had 3 time points, only a few random parameters could be included before the equation started to break down. As such, I chose to model the $(\gamma_{20i}FSVividpc_{ti})$ error term $(\mu_{2i}FSVividpc_{ti})$ because it was the only model for which the Maximum Likelihood estimates achieved convergence (i.e., successfully fit the model to the data)⁴.

⁴ Parameter estimates and their significance are computed using maximum likelihood

Figure 1. Empathic perspective taking change across time for the mental imagery and meditation conditions.

To account for between-person variability, I decomposed these same initial raw variables into level-2 predictors by creating copies of the grand sample mean as variables and centered them for each predictor. These centered grand-mean variables thus became time-invariant covariates –as they have the same value across time –and are denoted in the reduced-form equation by $(\gamma_{04}mFSVivid_i)$, $(\gamma_{05}mEmpPT_i)$, and $(\gamma_{06}mFSEmp_i)$. I also entered the raw value of trait Vividness of imagery and trait Empathic concern in the

estimations (ML). ML uses calculus as opposed to algebra to, as the name would suggest, provide estimates that maximize the likelihood that the parameters observed in one's sample data were obtained from (and are representative of) the population they were drawn from. ML estimates also include cases with missing data on predictor variables because the equation only requires a sum of observations for a group/person, even if this sum does not represent all time points/observations (e.g., Muthén & Curran, 1997).

Table 13.

Parameter Estimates (PE), Standard Error (SE), t-tests (t), and significance estimates (p) for Future self-continuity and trait Empathic perspective taking predicting Procrastination.

Model		PE	SE	t	p
A	$\gamma_{00intercept}$	2.96	.07	41.63	<.000
	γ_{10time}	-.09	.02	-3.55	.000
	$\tau_{00intercept}$	.75	.08	8.47	<.000
	σ^2_{resid}	.21	.01	11.87	<.000
B	$\gamma_{00intercep}$	3.00	.07	40.54	<.000
	γ_{10time}	-.09	.02	-3.46	.000
	$\tau_{00intercept}$	.83	.10	7.84	<.000
	τ_{11time}	.02	.01	1.63	.051
	τ_{10cov}	-.05	.03	-1.61	.108
	σ^2_{resid}	.18	.02	8.07	<.000
C	$\gamma_{00intercept}$	3.00	.07	40.20	<.000
	$\gamma_{01ImaMedi}$	-.16	.14	-1.13	.260
	γ_{02mFSC}	-.23	.11	-2.04	.042
	$\gamma_{03mEmpPT}$	-.22	.06	-3.25	.001
	γ_{10time}	-.09	.03	-3.00	.004
	$\gamma_{20FSCpc}$	-.03	.04	-.72	.474
	$\gamma_{30EmpPTpc}$	.48	.15	3.15	.001
	$\gamma_{11timeXImaMedi}$	.03	.06	.61	.543
	$\gamma_{12timeXmFSC}$	.03	.02	1.23	.218
	$\gamma_{13timeXmEmpPT}$	-.05	.04	-1.33	.184
	$\gamma_{21FSCpcXtime}$	-.02	.04	-.54	.591
	$\gamma_{31EmpPTpcXtime}$	-.27	.13	-2.00	.046
	$\gamma_{21FSCpcXImaMedi}$	-.02	.05	-.44	.661
	$\gamma_{31EmpPTpcXImaMedi}$	.12	.16	.80	.429
	$\gamma_{12ImaMediXmFSC}$	.02	.12	.23	.818
	$\gamma_{13ImaMediXmEmpPT}$	.03	.21	.17	.867
	$\tau_{00intercept}$	.76	.10	7.56	<.000
	τ_{11time}	.02	.01	1.60	.056
	τ_{10cov}	-.03	.03	-1.14	.256
	σ^2_{resid}	.17	.02	8.00	<.000

Note. ImaMedi = mental imagery contrast-coded .5 and meditation contrast-coded -.5, Proc = Total procrastination, FSCppc/mFSC = Future self-continuity, EmpPTpc/mEmpPT = Perspective taking. Model A is unconditional (no predictors) and TIME is fixed. TIME is left to vary randomly in Model B and in all subsequent models. Model C contains all time-variant (level-1; time, FSCpc, EmpPTpc) and time-invariant (level-2; ImaMedi, ,FSC, mEmpPT) predictors of total procrastination (Proc) and their interactions.

model as covariates to control for their effect on Future self-continuity. These are denoted by $(\gamma_{02}VMI_i)$ and $(\gamma_{03}EmpEC_i)$ and were kept raw because I was not interested in knowing how much within or between variance they account for in Future self-continuity. The interaction terms between $(\gamma_{10}time_{it})$ and the level-2 decomposed predictors were also entered in the model to determine if participants experienced steeper or flatter rates of Future self-continuity change based on these predictors (Aguinis, Gottfredson & Culpepper, 2013). These are denoted in the reduced form equation by $(\gamma_{14}Time_{it}mFSVivid_i)$, $(\gamma_{15}Time_{it}mEmpPT_i)$, and $(\gamma_{16}Time_{it}mFSEmp_i)$. Finally, The interaction terms $(\gamma_{14}ImaMedi_{it}mFSVivid_i)$, $(\gamma_{15}ImaMedi_{it}mEmpPT_i)$, and $(\gamma_{16}ImaMedi_{it}mFSEmp_i)$ were entered in the model to determine if condition determined the magnitude and direction of the influence of average Vividness of future self, trait Empathic perspective taking, and Affective empathic for future self on Future self-continuity.

Pertaining to condition parameters, the results indicate that participants who were randomly assigned to either the mental imagery or to the meditation condition did not differ on Future self-continuity at baseline and, as reviewed earlier, experienced similar rates of change across time. Furthermore, condition did not significantly influence the average effects of $(\gamma_{20i}FSVividpc_{it})$, $(\gamma_{30i}EmpPTpc_{it})$, $(\gamma_{40i}FSEmpc_{it})$, $(\gamma_{04}mFSVivid_i)$, $(\gamma_{05}mEmpPT_i)$, and $(\gamma_{06}mFSEmp_i)$ on Future self-continuity.

Turning to the main effects of the level-1 predictors $(\gamma_{20i}FSVividpc_{it})$, $(\gamma_{30i}EmpPTpc_{it})$, and $(\gamma_{40i}FSEmpc_{it})$, results demonstrate that only $(\gamma_{30i}EmpPTpc_{it})$ predicted participants' departure from their own Future self-continuity mean at Time 0. In other words, participants who are higher than their own average on Empathic

perspective taking also experience a higher connection to future self at baseline. On the other hand, the main effects of the level-2 predictors ($\gamma_{04}mFSVivid_i$), ($\gamma_{05}mEmpPT_i$), and ($\gamma_{06}mFSEmp_i$) indicate that participants who were higher than the grand sample mean on ($\gamma_{04}mFSVivid_i$) at Time 0 also experienced higher Future self-continuity at baseline.

Pertaining to the growth parameters, only level-1 predictors significantly interacted with time. Specifically, participants who were higher than their own mean on Vividness of future self and Affective empathy for future self at each subsequent time point also experienced a greater increase in Future self-continuity. The error term variances and covariance indicate that in this model, participants significantly varied around the fixed intercept and the average rate of change across time. Furthermore, participants significantly varied around their own Vividness of future self average. Finally, participants who started with a lower intercept value at baseline experienced steeper growth in Future self-continuity over time.

Table 14
Parameter Estimates (PE), Standard Error (SE), t-test (t), and Significance Estimates (p) for trait Empathic concern growth through time by condition

Model		PE	SE	t	p
A	γ_{00}	3.84	.04	79.30	<.000
	$\gamma_{01}ImaMedi$	-.10	.09	-1.13	.261
	$\gamma_{10}time$	.02	.02	1.30	.195
	$\gamma_{11}time \times ImaMedi$	-.02	.04	-.64	.523
	τ_{00}	.37	.04	8.01	<.000
	$\tau_{11}time$	.02	.00	2.81	.002
	$\tau_{10}cov$	-.02	.01	-2.00	.067
	σ^2_{resid}	.08	.01	8.50	<.000

Note. ImaMedi = mental imagery contrast-coded .5 and meditation contrast-coded -.5, EmpEC = Trait empathetic concern.

Surprisingly, participants who were higher than their own mean on trait Empathic perspective taking at each subsequent time point, as indicated by $(\gamma_{31i}EmpPTpc_{ti}Time_{ti})$, also experienced greater *decreases* in Future self-continuity across time. This finding does not make much theoretical sense, since increasing empathic perspective taking should allow a person to adopt a future-oriented perspective and connect to future self. Although one possibility could be that developing *general* perspective taking (i.e., the ability to put oneself in other people's shoes, and not necessarily in future self's shoes) may increase cognitive focus on other people and diminish focus on future self, these results could very well come from a statistical artefact.

To better understand this result, it is helpful to examine the correlations among these variables. Table 15 indicates that the correlation between Future self-continuity and trait Empathic perspective taking at Time 2 for the overall sample is on the weaker side and non-significant, but it is nonetheless positive. For the meditation condition specifically, this correlation is weak, *negative*, and non-significant (Table 16). For the mental imagery condition however, this correlation is positive, moderate, and significant (Table 17). Nonetheless, model C clearly indicates that there are no significant group differences in how trait Empathic perspective taking influences Future self-continuity, so these differing correlations cannot shed much light on the nature of $(\gamma_{31i}EmpPTpc_{ti}Time_{ti})$. Looking at these same tables, the correlations between trait Empathic perspective taking, Vividness of future self, and Affective empathy for future self indicate that these variables have moderate to weak correlations that differ between the two conditions. For the meditation condition, Affective empathy for future self and trait Empathic perspective taking are moderately and significantly correlated,

Table 15.

Pearson correlation matrix among Time 2 variables for the total sample.

Variables	1	2	3	4	5	6
1. T2FSC	-					
2. T2FSVivid	.54**	-				
3. T2FSEmp	.32**	.36**	-			
4. T2Proc	-.20*	-.08	-.06	-		
5. T2EmpEC	.12	.04	.35**	-.30**	-	
6. T2EmpPT	.15	.17*	.30**	-.22**	.52**	-
7. T2VMI	.30**	.60**	.31**	-.04	.13	.33**

Note. ** $p < .01$. * $p < .05$. T2FSC = Time 2 Future self-continuity, T2FSVivid = T2 Vividness of future self, T2FSEmp = T2 Affective empathy for future self, T2Proc = T2 Total Procrastination, T2EmpEC = Time 2 Trait Empathetic concern, T2EmpPT = Time 2 Trait Perspective taking, T2VMI = Time 2 Trait Vividness of imagery.

Table 16.

Pearson correlation matrix among Time 2 variables for the meditation condition.

Variables	1	2	3	4	5	6
1. T2FSC	-					
2. T2FSVivid	.50**	-				
3. T2FSEmp	.31**	.33**	-			
4. T2Proc	-.25*	-.14	-.06	-		
5. T2EmpEC	.12	-.05	.41**	-.28*	-	
6. T2EmpPT	-.02	.02	.34**	-.17	.60**	-
7. T2VMI	.23*	.45**	.17	-.05	.06	.23*

Note. ** $p < .01$. * $p < .05$. T2FSC = Time 2 Future self-continuity, T2FSVivid = T2 Vividness of future self, T2FSEmp = T2 Affective empathy for future self, T2Proc = T2 Total Procrastination, T2EmpEC = Time 2 Trait Empathetic concern, T2EmpPT = Time 2 Trait Perspective taking, T2VMI = Time 2 Trait Vividness of imagery.

Table 17.

Pearson correlation matrix among Time 2 variables for the mental imagery condition.

Variables	1	2	3	4	5	6
1. T2FSC	-					
2. T2FSVivid	.62**	-				
3. T2FSEmp	.30**	.37**	-			
4. T2Proc	-.08	-.00	-.03	-		
5. T2EmpEC	.05	.12	.25*	-.33**	-	
6. T2EmpPT	.30*	.27*	.20	-.26*	.44**	-
7. T2VMI	.37**	.71**	.43**	-.01	.20	.40**

Note. ** $p < .01$. * $p < .05$. T2FSC = Time 2 Future self-continuity, T2FSVivid = T2 Vividness of future self, T2FSEmp = T2 Affective empathy for future self, T2Proc = T2 Total Procrastination, T2EmpEC = Time 2 Trait Empathetic concern, T2EmpPT = Time 2 Trait Perspective taking, T2VMI = Time 2 Trait Vividness of imagery.

while Vividness of future self and trait Empathic perspective taking are non correlated.

On the contrary, the mental imagery condition demonstrates a moderate significant correlation between Vividness of future self and trait Empathic perspective taking, while Affective empathy for future self and trait Empathic perspective taking are non-correlated. Overall, these correlations do not seem strong enough to create suppression effects, but it could be possible that this is what created the reversal in trait Empathic perspective taking on Future self-continuity. Based on this information, I decided to create a model for each Vividness of future self, Affective empathy for future self, and trait Empathic perspective taking predicting Future self-continuity to see if the effects observed in model C would become stronger, weaker, or stay exactly the same.

Table 12, model D contains the level-1 and level-2 decomposed effects for trait Empathic perspective taking, as well as their interactions with time and ImaMedi. The

error variance and covariance terms indicate that participants significantly varied around the fixed intercept, the fixed slope for time, from their own Future self-continuity average across time, and that lower baseline Future self-continuity scores significantly influenced steeper change in Future self-continuity across time. Results of this model did not reveal any significant ($\gamma_{21}EmpPTpcXtime$) interaction, although this effect was negative like the one in model C. The main effects for ($\gamma_{02}mEmpPT$), ($\gamma_{20}EmpPTpc$) as well as the interaction ($\gamma_{12}timeXmEmpPT$) were also non-significant. Although model C and model D offer similar information, the estimates in model D are non-significant and lead me to conclude (to be safe) that trait Empathic perspective taking is not a significant moderator of change in Future self-continuity across time. Of course, to be scientifically thorough, I suggest that these findings be pursued in future research to explore if general empathic perspective taking is predictive of decreases in one's connection to future self.

In a similar fashion, model E contains the level-1 and level-2 decomposed effects for Affective empathy for future self, as well as their interactions with time and *ImaMedi*. Since Vividness of future self was not in this model, the error variance term ($\tau_{22}FSEmp$) could be included alongside the error variance term for the intercept and the time slope. As such, the error variance and covariance terms indicate that participants significantly varied around the fixed intercept, the average rate of change across time, from their own Affective empathy for future self and Future self-continuity average across time, and that lower baseline Future self-continuity scores were predictive of steeper Future self-continuity change across time.

The main effect ($\gamma_{02}mFSEmp$) was significant and indicates that the grand sample Affective empathy for future self mean is predictive of lower Future self-continuity score

at baseline. Interestingly, the covariance between (τ_{11time}) and $(\tau_{22FSEmpc})$ also demonstrates that participants who were lower than their own Affective empathy for future self average at a particular time point also experienced slightly steeper rates of change in Future self-continuity at that time point. This is contrary to the estimate for $(\gamma_{21FSEmpcXtime})$, which indicates that the fixed rate of Affective empathy for future self change for a person at each time point was predictive of steeper increases in Future self-continuity. However, this result is only marginally significant. Once again, to be safe, I conclude that Affective empathy for future self is not a significant moderator of change in Future self-continuity across time.

Model F contains the level-1 and level-2 decomposed effects for Vividness of future self, their interactions with time, *ImaMedi*, and the random terms for the intercept, and time. The error variance terms indicate that participants significantly varied around the fixed intercept, the average rate of change across time, from their own Vividness of future self and Future self-continuity average at each time point, and that lower baseline Future self-continuity scores were predictive of steeper Future self-continuity change in time. Similarly to Affective empathy for future self, results for the main effect $(\gamma_{02mFSVivid})$ demonstrates that the Vividness of future self grand mean was predictive of lower Future self-continuity at baseline. Importantly, $(\gamma_{21FSVividpcXtime})$ demonstrate that, as in model C, participants who were higher than their own mean on Vividness of future self at each subsequent time point also experienced a greater increase in Future self-continuity. Indeed, the probing of $(\gamma_{21iFSVividpc_{ti}Time_{ti}})$ interaction reveals that participants who experienced higher Vividness of future self at each time point also experienced a steeper rate of change in Future self-continuity across time (Figure 2).

As reviewed earlier, Vividness of future self significantly increased with time, while participants experienced significant variability around the fixed rate of growth for both Vividness of future self and Future self-continuity. Calculating the proportion of variance in model F that is explained by level-1 variance –by subtracting model A from F ($\sigma^{2\text{resid}}$) on model A ($\sigma^{2\text{resid}}$) –complements these findings: $.927 - .527/.927 = .431$. For level-2, model A from F ($\tau_{00\text{intercept}}$) is subtracted and divided by model A ($\tau_{00\text{intercept}}$): $.899 - 1.279/.899 = -.422$. This is similar if we repeat these calculations for model C level-1: $.927 - .492/.927 = .469$, and level-2: $.899 - 1.254/.899 = -.394$. This indicates that 43.1% to 46.9% of the variance in Future self-continuity is explained by level-1 variance, while -39.4% to -42.2% is explained –or in this case it may be more appropriate to say unexplained –by level-2 variance⁵. I believe that this combined evidence makes it safe to conclude that Vividness of future self is a predictor of Future self-continuity change across time. More specifically, Vividness of future self explains *how* participants came to feel more connected to future self at each time point (and uniquely from the sample average): because that self became more vivid from what a participant had experienced at a previous time point.

⁵ These are like increments in R^2 , but they are not algebraic, they are estimates derived from calculus.

Figure 2. Future Self-continuity (FSC) change across time for high and low vividness of future self (FSVividpc).

Mediators of vividness on future self-continuity

As mentioned in the section for hypothesis 2, the initially hypothesized mediation model could not be carried out because there were no observed condition differences for Vividness of future self and Affective empathy for future self. Since Affective empathy for future self and trait Empathic perspective taking were not significant moderators of Future self-continuity growth across time, these may be better conceptualized as mediators of the relation between Vividness of future self and Future self-continuity. As also mentioned in the section for hypothesis 2, there is empirical and theoretical evidence that this model could adequately explain the mechanisms that serve to foster Future self-continuity. In fact, the exploratory analyses revealed that Vividness of future self significantly explained why participants experienced change in Future self-continuity

across time. To better understand why Vividness of future self has this influence on Future self-continuity, a mediation model was created to determine if both affective and cognitive aspects of empathy could be fostered by Vividness of future self and in turn, influence Future self-continuity, or if only affective or cognitive empathy could mediate this relation.

To create this model, I decided to adopt Hayes and Preacher's (2014) 'MEDIATE' macro for SPSS. This macro allowed me to include multiple mediators in the model, to include trait Empathic perspective taking and trait Vividness of imagery as covariates to partial out their influence on Affective empathy for future self, trait Empathic perspective taking, and Future self-continuity, all the while using bootstrapping and confidence intervals to determine the significance of the mediated paths. As such, to adequately observe the unfolding of these mechanisms through time, Time 0 Vividness of future self was entered as a predictor of Time 2 Future self-continuity, while T1 Affective empathy for future self and trait Empathic perspective taking were included as mediators.

Results demonstrated that Time 1 Affective empathy for future self was the only significant mediator of Time 0 Vividness of future self on Time 2 Future self-continuity while controlling for T0 trait Empathic concern and trait Vividness of imagery (Figure 3). Specifically, the total effect between T0 Vividness of future self and T2 Future self-continuity was slightly reduced once the mediators were included in the model, but this direct effect was still significant. Furthermore, the indirect effect associated with T1 Affective empathy for future self is significant but slight. Overall, these findings indicate that Affective empathy for future self *partially* mediates the relation of Vividness of future self on Future self-continuity, but that other mediators certainly explain this

association. This model nonetheless offers evidence that affective empathy may serve to enhance the influence of Vividness of future self on Future self-continuity. This also indicates that forming a vivid mental image of future self may be enough to connect to that self, and that affective processes are not always necessary. Because this is an initial investigation, I will not be making any causal inferences regarding this model. These results certainly need to be replicated and strengthened with improved designs that this research project will hopefully adequately inform.

Figure 3. ** $p < .01$. * $p < .05$. Mediation of the relation between T0-FSVivid and T2-FSC through T1FSEmp and T1-EmpPT. T0-VMI and T0-EmpEC are covariates of T1-FSEmp, T1EmpPT, and T2-FSC. T0 = Time 0, T1 = Time 1, T2 = Time 2, FSVivid = Vividness of future self, FSEmp = Affective empathy for future self, EmpPT = Trait perspective taking, VMI = Trait vividness of mental imagery, EmpEC = Trait empathetic concern.

Predictors of Procrastination change across time

Although extremely slight, results of the analyses summarized in Table 13 nonetheless reveal that Procrastination significantly reduced with time. As reviewed in the section for hypothesis 3, there were no group differences in Time 2 Procrastination. However, Future self-continuity was a significant overall predictor of decreases in Procrastination at Time 2. To determine if change in Future self-continuity across time could predict change in Procrastination, Future self-continuity was decomposed into within ($\gamma_{20}FSCpc$) and between-person ($\gamma_{02}mFSC$) components and entered in a model along with the decomposed effects for trait Empathic perspective taking, ($\gamma_{30}EmpPTpc$) and ($\gamma_{03}mEmpPT$), and their interactions with time and ImaMedi ($\gamma_{12}TimeXmFSC$), ($\gamma_{13}TimeXmEmpPT$), ($\gamma_{21}FSCpcXTime$), ($\gamma_{31}EmpPTpcXTime$), ($\gamma_{21}FSCpcXImaMedi$), ($\gamma_{31}EmpPTpcXImaMedi$), ($\gamma_{12}ImaMediXmFSC$), and ($\gamma_{13}ImaMediXmEmpPT$). Trait Empathic perspective taking was entered in the model as a possible predictor of Procrastination because it was not a significant moderator or mediator of Future self-continuity and, as such, could operate alongside Future self-continuity when predicting patterns of change in Procrastination. Lastly, only the intercept and the slope for time were left to vary randomly. Consequently, the unconditional model for Procrastination is represented in Table 13, model A. The ICC for Procrastination is:

$$\begin{aligned} &.757/.757 + .217 = \\ &.757/.974 = \\ &.793 \end{aligned}$$

This indicates that 79.3% of the variability in Procrastination comes from between people variability. Adding in the predictors, model C is represented by the following equation:

$$\text{Level-1: } y_{ti} = \beta_{0i} + \beta_{1i}Time_{ti} + \beta_{2i}FSCpc_{ti} + \beta_{3i}EmpPTpc_{ti} + \beta_{21i}FSCpc_{ti}Time_{ti} + \beta_{31i}EmpPTpc_{ti}Time_{ti} + r_{ti}$$

$$\text{Level-2: } \beta_{0i} = \gamma_{00} + \gamma_{01}ImaMedi_i + \gamma_{02}FSC_i + \gamma_{03}EmpPT_i + \gamma_{12}ImaMedi_iXmFSC_i + \gamma_{13}ImaMedi_iXmEmpPT_i + \mu_{0i}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}ImaMedi_i + \gamma_{12}mFSC_i + \gamma_{13}mEmpPT_i + \mu_{1i}$$

$$\beta_{2i} = \gamma_{20} + \gamma_{21}ImaMedi_i$$

$$\beta_{3i} = \gamma_{30} + \gamma_{31}ImaMedi_i$$

Reduced form:

$$y_{ti} = \gamma_{00} + \gamma_{01}ImaMedi_i + \gamma_{02}mFSC_i + \gamma_{03}mEmpPT_i + \gamma_{10}time_{ti} + \gamma_{20i}FSC_{ti} + \gamma_{30i}EmpPTpc_{ti} + \gamma_{11}Time_{ti}ImaMedi_i + \gamma_{12}Time_{ti}mFSC_i + \gamma_{13}Time_{ti}mEmpPT_i + \gamma_{21i}FSCpc_{ti}Time_{ti} + \gamma_{31i}EmpPTpc_{ti}Time_{ti} + \gamma_{12}ImaMedi_imFSC_i + \gamma_{13}ImaMedi_imEmpPT_i + \gamma_{21}FSCpc_{ti}ImaMedi_i + \gamma_{31}EmpPTpc_{ti}ImaMedi_i + \mu_{0i} + \mu_{1i}time_{ti} + r_{ti}$$

Results of model C reveal that the fixed average of ($\gamma_{02}mFSC$) and ($\gamma_{03}mEmpPT$) both significantly predict lower Procrastination baseline scores. Furthermore, participants who deviated from their own trait Empathic perspective taking average ($\gamma_{30}EmpPTpc$) experienced higher Procrastination scores at baseline. The error variance estimates demonstrate that participants significantly varied around the fixed intercept and their own Procrastination pattern of change across time. However, all participants followed an average fixed rate of change in Procrastination across time.

Surprisingly, only the within-person component of trait Empathic perspective taking significantly interacted with time. There was, unfortunately, no such significant effect for Future self-continuity. Probing of this significant ($\gamma_{31}EmpPTpcXTime$) interaction revealed that participants who experienced higher trait Empathic perspective taking at each time point also experienced decreases in Procrastination, while participants who experienced lower increases in trait Empathic perspective taking at each time point did not experience any significant decreases in Procrastination (Figure 4).

Figure 4. Procrastination (Proc) change across time for high and low empathic perspective taking (EmpPTpc).

The proportion of variance in model C explained at level-1 was: $.217 - .177 / .217 = .184$, while the proportion of level-2 variance explained was: $.757 - .763 / .757 = -.0079$. As previously mentioned, the ICC indicated that almost 80% of the variance in Procrastination was found at level-2. However, model C does not predict any variance at level-2. Furthermore, although participants varied around their own rate of change across time, the residual variance ($\tau_{1|time}$) indicates that participants do not vary around the average fixed rate of change for Procrastination.

Taken together, these results indicate that the sample experienced slow and average decreases in Procrastination over time. As such, the predictors entered in Model C were successful at informing *how* participants varied from their own fixed rate of change over time -which is important in and of itself—but were not successful at

explaining why participants followed this fixed rate of change, which is where the bulk of the variance in Procrastination seems to lie.

General Discussion

The purpose of this masters thesis was to explore how fostering a vivid, emotional, and empathic connection to future self may allow a person to regulate present behaviour within a broader cognitive-affective scope and as such, reduce academic procrastination. Specifically, I hypothesized that a person's connection to future self operates similarly to one's connection to other people. Indeed, procrastinators have a higher likelihood of perceiving future self as they do a stranger and as a result can easily disregard the possibly negative consequences of their present actions on future self (i.e., Sirois & Pychyl, 2013; Blouin-Hudon & Pychyl, 2015). By feeling another person's emotions, empathy allows one to incorporate their sense of self within the boundary of the other (Cwir, Carr, Walton, & Spencer, 2011; Cialdini, Brown, Lewis, et al., 1997). Accordingly, a future self that is initially perceived as a stranger can be made to feel like an extension of who one is today by cultivating empathy for that self.

Before an emotional connection to future self can be forged, however, a person must be able to imagine that self so that it may become cognitively vivid and emotionally salient. A well documented finding from the mental imagery literature indicates that people who are able to create vivid mental images (i.e., sights, sounds, smells, tastes, and touch) also experience enhanced affective states regarding these images (Ley, 1979; Sheikh & Kunzendorf, 1984; Ellis, 1962; Kosslyn, Ganis, & Thompson, 2001; Damasio, 1999; Holmes et al., 2006; Holmes et al., 2008; Blair, Ma, & Lenton, 2001). Guided by

this evidence, I hypothesized that creating a vivid mental image of future self would allow a person to experience what that self may be feeling at a particular point in time. Because my research was focused on academic procrastination, I decided to design a guided mental imagery practice that would paint a clear image of future self at the end of the academic semester.

To create a felt reality, I incorporated all facets of mental imagery, such as textures, sounds, weights, and sights, into the mental imagery condition script. Furthermore, to allow participants to experience future self in a more phenomenological way, while also perceiving that self under more conceptual circumstances, I designed the mental imagery scenario to portray future self in a first and third-person perspective (Libby & Eibach, 2011; Conway, 2005; Vasquez & Buehler, 2007). As a contrast to the mental imagery practice, I chose a present-focused meditation for the control condition that also incorporated certain aspects of mental imagery, mainly associated with feeling stress inside one's body.

I hypothesized that participants subjected to the mental imagery condition would experience greater increases in vividness of future self, affective empathy for future self, and future self-continuity. Specifically, I reasoned that consistently imagining future self in a multi-sensory and multi-perspective way would allow participants in the mental imagery condition to slowly build and improve their mental image of future self over time and, as a consequence, to feel more connected to that self. Ultimately, I hypothesized that participants in the mental imagery condition would report less procrastination at the end of the study because of their greater connection to future self.

Results of hierarchical linear regressions revealed that participants in the mental imagery condition experienced a greater connection to future self at the four-week mark than participants in the meditation condition. While trait empathic perspective taking (i.e., the ability to put oneself in another person's shoes) was included in the study as a control variable, participants in the mental imagery condition experienced greater empathic perspective taking than participants in the meditation condition. Lastly, although there was no condition differences in this effect, increases in future self-continuity at the four-week mark was predictive of decreases in procrastination.

To further these findings, latent growth curve multilevel model analyses were adopted to explore if these variables demonstrated change across time and if this change could be explained by differences linked to condition or individuals. The results of these analyses revealed that participants experienced change on almost all variables; procrastination decreased across time, while vividness of future self, empathy for future self, and future self-continuity increased. Surprisingly, only empathic perspective taking change across time was dependent on condition. Specifically, participants in the mental imagery condition experienced greater and steeper increases in empathic perspective taking, while participants in the meditation condition did not experience any significant change across time.

These unexpected results indicate that condition differences in empathic perspective taking change across time and four-week mark scores could possibly explain the significant condition differences in future self-continuity at the four-week mark. To explore this, empathic perspective taking was included in a model to predict change in future self-continuity alongside affective empathy for future self and vividness of future

self. As I had initially theorized and expected, how much a person increased from their own vividness of future self mean at each time point predicted greater increases in future self-continuity across time. In short, this model suggested that participants' connection to future self across time was intensified when that self became more vivid. Contrary to hypotheses, however, there were no differences between conditions for these effects. In fact, participants demonstrated much variability in their pattern of change from others and from themselves at each time point. Surprisingly once again, results of this model also indicated that a person's *decrease* from their own mean in empathic perspective taking at each time point predicted greater increases in future self-continuity.

To further examine these effects, vividness of future self, affective empathy for future self, and empathic perspective taking were included in separate models to predict future self-continuity. Of these individual models, only vividness of future self significantly determined the extent to which a person's connection to future self increased at each time point. Although the association of empathic perspective taking and change in future self-continuity across time was yet again negative, this effect was non-significant.

Results of the affective empathy model were quite inconsistent; when participants were lower than their own affective empathy mean at each time point, they also experienced greater increases in future self-continuity. On the contrary, a person's unique fixed pattern of change in affective empathy influenced greater connection to future self at each time point, albeit this effect was marginally significant.

Because of the inconclusive findings for affective empathy for future self and empathic perspective taking, I chose to conclude that the rate of change in future self-continuity across time in my sample depends solely on how vivid future self becomes for

a person at each time point. Since future self can only be imagined, this finding is in accordance with the idea that a temporal connection to that self must first rely on a clear and vivid mental image. Once that image has been developed and perfected, a person can begin to experience emotions associated with that image. As such, the influence of affective empathy may be more adequately conceptualized firstly as an outcome of vivid mental images, and secondly as a predictor of future self-continuity.

Based on findings from the future self-continuity as outcome models and on previous findings providing initial evidence for the role of cognitive and affective processes in future self-continuity (Blouin-Hudon & Pychyl, 2015), I created a mediation model to explore if vividness of future self could predict increases in affective and/or cognitive empathy (perspective taking), which in turn, could predict increases in future self-continuity. In this model, affective empathy for future self was the only significant partial mediator of the relation of vividness and future self-continuity. This supports the idea that feeling warm and affectionate towards future self can be useful in connecting to that self, but first, that empathic connection has to be inspired by a vivid mental image of future self. However, the partial mediation indicates that affective empathy for future self certainly is not the only mediator in this model and suggests that other processes stemming from vivid mental imagery may also explain a person's connection to future self, such as optimism, for example (Blackwell, Rius-Ottenheim, Schulte-van Maaren, et al., 2013). A more complex mediation model should undoubtedly be explored in future research.

The partial mediation may also indicate that the association between vivid mental images of future self and future self-continuity can be quite direct. In fact, the study in

general seems to have had quite a strong effect on cognitive processes and most specifically on developing vivid future self imagery. To highlight this observation, participants for whom future self was less vivid and who had lower trait abilities in forming general mental images experienced greater increases in these variables across time. This was not the case for participants who had lower affective empathy for future self or lower trait empathic concern.

With a better understanding of how my study influenced cognitive and affective processes to foster future self-continuity, I then designed a latent growth curve model to determine how and why procrastination decreased across time. Since empathic perspective taking did not have a significant association with future self-continuity –and even demonstrated that it could possibly be detrimental for connecting to future self –I included this variable as a possible predictor of change in procrastination alongside future self-continuity. Once again, empathic perspective taking revealed surprising results; participants who experienced increases in empathic perspective taking from their own mean at each time point also experienced greater decreases in procrastination. Unfortunately, none of the effects for future self-continuity predicting change in procrastination across time were significant.

What could explain differences and similarities across conditions?

As previously mentioned, one of the core goals of this masters thesis was to determine if consistently practicing future self related mental imagery could foster a greater connection to that self. Since participants in the mental imagery condition experienced a significantly greater connection to future self at the four-week mark, I can

conclude with some confidence that the experimental manipulation was successful in achieving this goal. However, the experiment was not successful at empirically dissociating why participants in the mental imagery condition felt more connected to future self than participants in the meditation condition. In fact, participants in both conditions demonstrated the same rate of change in future self-continuity, vividness of future self, and affective empathy for future self over time.

These results are somewhat surprising because I would have expected participants who were directly imagining future self to experience more vividness and affective empathy for that self than people who simply focused on their present self. As such, it is possible that the mental imagery manipulation did not stimulate vividness and affective empathy for future self over and above their naturally occurring associations over time. For example, as the end of the semester neared, future self became temporally closer, and likely more vivid and cognitively accessible. As the mediation model in hypothesis 2 demonstrated, this increased vividness also increased affective empathy for future self. This could explain in part why the sample as a whole generally experienced a greater connection to future self over time.

Another very plausible explanation is that both the mental imagery and the meditation conditions stimulated vividness, empathy, and a connection to future self over and above their natural occurrence. Indeed, the stress reduction meditation practiced by participants in the control condition is representative of a specific instance of mindfulness meditation (Ospina, Bond, Karkhaneh, et al., 2007). Interestingly, taking a mindful stance towards one's self can increase self-acceptance and cognitive flexibility (Carson & Langer, 2006; Moore & Malinowski, 2009), which involves the ability to switch one's

attention between changing stimuli and to consider different aspects or perspectives of an object, idea, or image⁶ (e.g., Cañas, Quesada, Antolí, & Fajardo, 2003; Eslinger & Grattan, 1993; Kim, Johnson, & Gold, 2012). Of particular relevance, mindfulness meditation can help a person increase their autobiographical memory accuracy and detail (Heeren, Broeck, & Philippot, 2009), which is necessary to create more complex images of the future (e.g., Williams, Ellis, Healy, et al., 1996; Suddendorf & Corballis, 2007, 1997). As such, participants in the meditation condition may have experienced increases in cognitive flexibility over the four weeks of the experiment, which likely contributed to their increased vividness and affective empathy for future self, and ultimately, their connection to future self.

Although I cannot directly test this assumption within the context of this masters thesis, I believe that this increase in cognitive flexibility explains why both conditions experienced very similar rates of change in vividness, affective empathy, and future self-continuity across time. Furthermore, participants in the mental imagery condition directly focused their imagination on future self at the end of the semester. As such, the idea that participants in the meditation condition experienced increases in mental flexibility, but that their imagination was not guided to connect to future self specifically, could explain why the mental imagery condition felt more connected to future self at the four-week

⁶ It is also interesting to know that the Anterior Cingulate Cortex (ACC) is activated when a person is using mental flexibility functions (Leber, Turk-Browne, & Chun, 2008). As I reviewed in the introduction, the ACC and other areas of the Cortical Midline structures are not activated when people low on future self-continuity think of future self, but it does activate when they think of themselves in the present (Ersner-Hersfield, Wimmer, & Knutson, 2009). Now the link between mindfulness meditation and/or future-focused mental imagery, mental flexibility, the ACC, and future self-continuity is too far-reaching to be a relevant interpretation for the results of this masters thesis. However, this could be a very interesting area of investigation for future research.

mark, and also why connection to future self was driven by the same cognitive-affective processes for the sample as a whole across time.

Since all of the variability in future self-continuity was explained by level-1 processes (i.e., how individuals differ from themselves over time), it is clear that more research should be conducted to clearly and cleanly dissociate how mindfulness meditation relates to vividness of mental imagery and affective empathy in order to explain more level-2 variability (i.e., why individuals differ from others). Do cognitive-affective resources operate similarly with future self-continuity when stemming from mindfulness as they do with future specific mental imagery? Does a connection to future self that is obtained through either future-focused mental imagery or mindfulness meditation influence procrastination in similar ways? Results of this masters thesis seem to point to the answer that both of these methods can achieve similar outcomes, but this should be specifically tested with an alternative control group and an improved research design.

Empathic perspective taking: Is it helpful or detrimental?

As reviewed earlier, my results revealed that participants in the mental imagery condition developed empathic perspective taking over and above the meditation condition both across time and at the four-week mark. However, the effect of empathic perspective taking was twofold: on the one hand, being able to generally adopt the perspective of others influenced a greater decrease in procrastination over time, but also suggested a negative influence on future self-continuity.

One important feature of empathic perspective taking is the ability to let go of egocentric biases (i.e., perspectives, affective states, beliefs) in order to understand and adopt another person's outlook on different situations –a cognitive process also known as theory-of-mind (Van Boven & Loewenstein, 2005). Of course, people often mispredict how they will feel in future situations, which can also reduce their ability to accurately adopt another person's perspective (Loewenstein, 1996; Loewenstein, O'Donoghue, & Rabin, 2003). In light of present-self biases characteristic of procrastination (e.g., Sirois & Pychyl, 2013; Ferrari & Diaz-Morales, 2007; Jackson, Fritch, Nagasaka, & Pope, 2003), I believe that imagining future self allowed participants in the mental imagery condition to clearly see what that self might be going through at the end of the semester, which improved participants' perspective taking accuracy and allowed them to act in ways that would benefit future self (i.e., reducing procrastination).

Understanding the association between empathic perspective taking and procrastination under these terms can also shed light on its association with future self-continuity. Specifically, empathy is a complex and multidimensional construct that involves an affective response and emotional overlap with another person, a cognitive aspect characterized by adopting the perspective of another, and the ability to monitor one's own emotions to dissociate self from the other (e.g. Batson, 1991; Decety & Jackson, 2004; Ickes, 1997). In this case, what may be inhibiting a person who has greater abilities in perspective taking from connecting to future self may be this third component of empathy; when adopting the perspective of another –or of future self –the self-other overlap is partial as to allow a person to differentiate their own sense of identity from the other.

Interestingly, research supporting this has demonstrated that people who adopted the perspective of another person in pain demonstrated increased activity in the same brain areas as when thinking of oneself in pain (Jeannerod & Pacherie, 2004). However, certain areas associated with one's sense of agency and self-identification were also activated when thinking from another person's perspective. Although this egocentric function of empathy is clearly adaptive for keeping the self distinct from the other (i.e., whose feelings belong to whom; Decety & Jackson, 2004), results of this masters thesis suggest that it may be less beneficial for connecting to future self.

Indeed, research investigating helping behaviour and empathy has demonstrated that imagining how a person may feel in a distressing situation inspired more helping behavior, while imagining oneself in the same situation was predictive of egoistic motivation (Batson, Early, & Salvarani, 1997). As mentioned in the introduction, imagining future self from a third-person perspective reduces the emotional impact of the mental image (Holmes & Mathews, 2010; Sutin & Robins, 2010) and allows a person to perceive that self under a more conceptual light (Libby and Eibach, 2011). As such, it is very possible that the third-person perspective portion of the mental imagery script developed empathic perspective taking, while the first-person portion of the script inspired a more phenomenological and affective empathic reaction to future self (Holmes, Coughtry, & Connor, 2008). Ultimately, feeling that future self is a direct extension of who one is in the present is very similar to imagining how oneself may feel in a distressing situation. On the contrary, imagining future self from a more removed, disconnected, yet still empathic, third-person perspective very much resembles imagining how another person would feel in a distressing situation.

Although this is not what I was expecting to find, I believe that perceiving future self from a more distanced perspective, while nonetheless understanding how that self may feel at the end of the semester, is important for increasing an altruistic motivation towards that self, mainly by getting tasks done on time. However, I must conclude that forging an intimate, emotional connection to future self at the end of the semester may not have as much of an influence on procrastination as previously thought. This could also explain why there were not any group differences in decreases in procrastination; participants in the mental imagery condition most likely achieved this distancing from taking a third-person stance, and participants in the meditation group from taking a mindful stance. This does not necessarily mean that future self-continuity and procrastination are not related, however. As demonstrated in hypothesis 3 and in Blouin-Hudon & Pychyl (2015), future self-continuity consistently accounts for 3% to 4% of the variance in procrastination when assessed with the seven overlapping circles. When observing how these constructs associate across time, I believe that dissociating the nuances in the nature of one's connection and/or empathic orientation to future self (cognitive or affective) is important to fully understand the role of the temporally extended self in relation to procrastination behaviour.

One thing is certain, more work has to be done to determine how imagining future self from a first versus a third-person perspective relates to cognitive and affective empathy. In turn, future research should examine how *understanding* what future self may be feeling, as opposed to emotionally merging present self into future self, translates to altruistic motivations for that self, such as procrastinating less. Furthermore, studies should be specifically designed to differentiate the components of mindfulness meditation

that contribute to an emotional connection to future self, and the ones that allow a more distanced, cognitive empathic stance towards that self. This can be achieved with a study design involving four groups: meditation, first-person mental imagery, third-person mental imagery, and control. Ultimately, research has yet to determine if empathic processes as understood from self-other overlaps should be re-conceptualized when exploring the connection between present and future selves, or if this imaginary, intrapersonal relationship truly does rest on interpersonal empathic processes.

Limitations

This masters thesis has shed an initial glimmer of light on the role of the temporally extended self in relation to procrastination, and importantly, on the cognitive and affective processes that can be manipulated –using ones imagination –to forge an emotional connection to, and/or to adopt a more distanced perspective of future self at the end of the academic semester. Nonetheless, this research has many flaws that should be reflected upon and improved in future endeavours.

Firstly, the mental imagery script was written in a way that would give participants some imaginary freedom to project themselves into future self as someone who had procrastinated or as someone who had completed tasks on time. I had decided to do this for this initial investigation as a way to understand if procrastination behaviour would differ for participants who had projected themselves in a positive versus a more negative way. Although I have some data on emotions for future self, knowing exactly if participants connected to their future self positively or negatively would have allowed me to gain important information on how to improve the mental imagery script for future

studies. I believe that this is an important drawback, and as such, gaining more qualitative insight on the nature of one's connection to future self should be a central goal for future research designs.

Secondly, I believe that it is important to keep exploring how the constructs investigated in this masters thesis associate and evolve across time. To do this, it is crucial to include five or more time points in order to detect non-linear growth. Indeed, with more time points, I believe that this study would have detected non-linear growth in affective empathy for future self. More specifically, it would have been appropriate to model piecewise growth for affective empathy, which involves fitting a slope for pre-specified "chunks" of time (Curran, Obeidat, & Losardo, 2010). Recalling the findings in Table 12, model E, results revealed that when participants differed from themselves over time, lower affective empathy for future self influenced greater future self-continuity. However, participants demonstrated a fixed increase in affective empathy at each time point, which influenced greater future self-continuity. To visualize this, a non-parametric loess curve was applied to the graph in Figure 5 (Appendix R). As can be observed in Figure 5, affective empathy goes down from Time 0 to Time 1 –especially for the meditation condition –and goes back up again from Time 1 to Time 2. In this case, it may not have been appropriate to assume a linear trend for this variable (Bauer, 2009). With additional time points, future studies will gain more power to appropriately model possible non-linear change across time.

Similarly, including follow up assessments would be extremely useful to determine how long the observed effects last post-intervention. Because mental imagery and meditation have a strong link to memory processes (e.g., Bagley, 1987; Zeidan,

Johnson, Diamond, et al., 2010), I would expect participants to be able to retrieve and hold a vivid mental image of future self a few months after mental imagery/meditation training. Accordingly, an improved research design should include follow-up measures to determine if the mental imagery and/or meditation practice can have lasting benefits.

Thirdly, I believe that this masters thesis suffered from not having an appropriate control condition. Although including a meditation practice revealed important findings on how meditation can relate to future self-continuity and procrastination, the effects observed in this study nonetheless need to be tested against the naturally-occurring associations of these constructs across time. Specifically, most of the variance in procrastination was at level-2, but predictors in the procrastination model only explained variance at level-1 (i.e., how participants differed from themselves across time). I believe that having an alternative control group would have increased power to determine why participants differed from each other in their procrastination behaviour across time.

Furthermore, I believe that including a measure of procrastination that was worded to reflect a trait-like orientation greatly reduced the sensitivity of the measure to change across time. Indeed, for each of the three time points, participants were asked about their general and usual procrastination behaviour, such as: “What major academic tasks do you typically do in your courses?” Although trait-like measures can demonstrate change across time, as was observed with empathic perspective taking, a measure of procrastination that asked participants which tasks they procrastinated on weekly, or even daily would have increased power to detect possible differences in procrastination across conditions. Furthermore, I would have been able to determine if the meditation and/or imagery practice truly had an effect over and above the decrease in procrastination across

time that may have been due to the end of the semester approaching. As such, I strongly believe that future research will gain power by measuring procrastination using a state-like measure at multiple points in time.

Along the same lines, I did not expect to find significant effects with cognitive empathy, as I was solely focused on exploring the emotional connection between present and future self. As such, this masters thesis did not have a measure of empathic perspective taking for future self specifically like it did with affective empathy. To adequately understand the association of cognitive empathy with future self-continuity and procrastination, such a measure should be included in future research designs.

Finally, it is important to mention that the effects observed in this masters thesis were a result of four weeks of future-focused mental imagery or present-focused meditation practice. If this can be afforded, I believe that future research could greatly benefit from allowing participants to practice these cognitive skills –and to reap their possible cognitive-affective benefits –for six to eight weeks (or even longer). Although slightly far-reaching, the wisdom of Indian philosophy found in the *Brāhmaṇas* illustrates the importance of consistent practice very well: “...time and continuity were not simply and deterministically given to man; rather, they are the result of a constant effort at prolongation, a constant pushing forward of life...” (Collins, 1982, p.42).

Implications

To quote Edward O. Wilson (2013): “Only rarely does an initial investigation result in a clear delineation of all possible competing hypotheses” (p. 59). Knowing this, it is clear that this master’s thesis has brought forth more questions than answers.

Notwithstanding the many avenues for future research and limitations to the present research design, this investigation has nonetheless important implications that should be highlighted. While past research has demonstrated a link between procrastination and self-discontinuities (i.e., Sirois & Pychyl, 2013; Blouin-Hudon & Pychyl, 2015), interventions aimed at reducing this self-defeating behaviour mostly focus on present-oriented cognitive-behavioural techniques (e.g., Dryden, 2012), cognitive-motivational techniques such as Personal Projects Analysis (Pychyl & Binder, 2004) and self-efficacy focus groups (Wang, Qian, Wang, & Chen, 2011). As such, this research is the first to explore ways to decrease the present- and future-self gap that partly characterizes procrastination in order to help individuals make decisions in the present that will have lasting benefits for the future.

Although more work has to be done before a mental imagery practice can be directly applied to procrastination intervention, findings do suggest that a program designed to develop one's ability to imagine future self—be it in a more cognitive or affective way—could generate great interest in the academic and financial domains. Indeed, financial companies have directly applied Hal Hershfield and colleagues' (2009, 2011) findings on digital aging and future self-continuity to increase the success of their programs and help individuals make financial decisions that will benefit them in the distant future (e.g., McAuley, 2015). For universities, such a program could be helpful to more than half of undergraduates who regularly engage in procrastination (e.g., Day, Mensink, & O'Sullivan, 2000). Accordingly, the present research has the potential to offer low cost and low energy methods to increase adaptive temporal decision making by exploring how to develop individuals' imagination directly. Once refined, the methods

explored in the present research could be included in short online videos posted on company or university websites, or could be made available as downloadable audio files to allow a person to practice whenever and wherever would suit them best.

More broadly speaking, I believe that the present masters thesis offers important insight into the psychological underpinnings of the imagination. I believe that becoming more aware of our imagination is of the utmost importance for developing the understanding that we are, for the most part, in control of our own well-being. Accordingly, the present research suggests that the perspective adopted to imagine future self can have very different outcomes for one's connection to future self and ultimately, whether a person honours that self when making present decisions. This research has also highlighted that imagining to feel something much more intangible like stress can free up the mind-space and have potential benefits for one's ability to include future self into present awareness. These benefits of training the imagination are highlighted in feedback obtained from participants in the mental imagery condition (feedback 1) and in the meditation condition (feedback 2):

I have really enjoyed participating in this study. It was useful to me in unexpected ways. I recently had an MRI and **used the imagery practice to manage the anxiety** of being in a confined, loud space whilst in pain. **Picturing myself studying after having repeatedly done so made the time pass and helped distance me from what was going on**, so thank you.

I just wanted to say thank you for you letting me participate in your study. I really enjoyed the audio track and **I find myself feeling better about procrastination, basically in how I view it and ways I can overcome it. I feel I will listen to the audio track again, whenever I am feeling a little anxious or doubtful.**
Thank you.

Our imagination holds great power, but we can only truly reap its benefits by more fully understanding the processes that accompany and foster our experience of this

inner world. As such, the present masters thesis has contributed some findings that contribute to this understanding. If this can be beneficial to future research and intervention programs looking to train our ability to imagine, then the present research has fulfilled its purpose.

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Appendix A

Demographics questionnaire

1. Please indicate your biological sex: Male Female
2. Please indicate your age:
3. Please indicate the program in which you are enrolled at Carleton University:
4. Please indicate your year of study: First Second Third Fourth Other
5. Please indicate if you are enrolled at Carleton University for full-time or part-time studies: Full-time Part-time

Appendix B

Multifaceted Measure of Procrastination (MMOP)

This document has three sections.

The main procrastination items are in section 2. Researchers may use this section alone if they are interested in measuring procrastination on academic tasks in general. Section one consist of two probe questions and are included to stimulate students to think about specific and major tasks that they often procrastination on while answering procrastination items in section two. So it need to be positioned before procrastination items. This can provide some descriptive information about the tasks that student procrastinate more.

Section three can be used to understand the task that student have in mind as a reference task when answering procrastination items in section 2. Identifying the reference task may help researchers to differentiate procrastination on various tasks. One may reduce the tasks in section 1 and 3 or add new tasks to the list.

-----SECTION 1-----Task Probe Questions:-----

TP_Q1) Below is a list of important and common tasks in school setting. What major academic tasks do you typically do in your courses? (Choose ALL that apply)

- ☐ Exam preparation (studying for exams)
- ☐ Writing assignment
- ☐ Assigned readings
- ☐ Writing Term paper
- ☐ Writing Essay
- ☐ Writing Thesis
- ☐ Lab report
- ☐ Illustration projects or drawing
- ☐ Problem sets
- ☐ Questions on readings or discussions
- ☐ Presentation
- ☐ Practical projects (e.g., software or game development; programming)
- ☐ Group project
- ☐ Other:

TP_Q2) On which task do you delay more? (Only choose ONE TASK even if you delay many)

- ☐ Exam preparation (studying for exams)
- ☐ Writing assignment
- ☐ Assigned readings
- ☐ Writing Term paper
- ☐ Writing Essay
- ☐ Writing Thesis
- ☐ Lab report
- ☐ Illustration projects or drawing
- ☐ Problem sets
- ☐ Questions on readings or discussions
- ☐ Presentation

- Practical projects (e.g., software or game development; programming)
- Group project
- Other:

-----section 2-----Procrastination Measure-----

Procrastination Behaviour

This questionnaire asks about needless delay in your academic life. It may be very frequent, or you may almost never delay anything. We are interested in your thoughts and emotions when you do delay on academic tasks such as studying for exams, writing assignments (e.g., essays, reports, thesis), or assigned readings.

Please note the following before answering:

- There are no right or wrong answers. We are only interested in how often you delay academic tasks and how it affects you.
- Some questions may seem similar to each other. Your answers to all questions will help us to refine the survey for future research.
- In answering the questions, **please consider the major academic tasks and what you have typically done in the recent past (current semester or last semester).**

Some of the questions use the phrase “**needless delay**.” Needless means delaying without a rational reason. When it’s needless delay, you generally know that this isn’t a good idea to delay the intended task. For example, if you intended to work on an academic task (e.g., study for an exam) at a particular time but instead engaged in “unnecessary activities” and then studied at the last minute, this would be needless delay.

Unnecessary activities typically are not urgent and are not part of one’s initial plan. For example, you may watch TV, spend time on facebook, or clean your room instead of studying for your exam as you initially intended. In answering the questions below, use your honest judgment. Only you can determine if your delay was needless.

Response options:

- 1=Never
- 2= Almost never
- 3=Occasionally
- 4=Often
- 5=Very often
- 6=Always

Items:

1. I initially intend to not put off academic tasks, but I continuously find myself doing so.
2. I don’t intend or plan to work on academic tasks, and I do other fun things instead.
3. When academic tasks are assigned, I tell myself that I will not start them late, but I end up delaying them without a good reason.
4. I intentionally choose to do fun stuff instead of doing academic tasks ahead of their deadline.

5. There is a needless delay between when I want to do academic tasks and when I actually do them.
6. I do not really care if I get a bad grade due to working on an academic task at the last minute.
7. I choose to do fun activities instead of getting an early start on academic tasks and I do NOT feel bad about it.
8. I postpone academic tasks despite expecting to be worse off if I delay.
9. When I receive an academic task, I don't give it any thought at all, and I do it at the last minute.
10. I plan to work on academic tasks ahead of time, but when the time comes, I needlessly postpone the tasks.
11. Instead of working on academic tasks according to my intention, I involve myself in some activities that are not urgent.
12. I keep putting off academic tasks until later without any rational reason.
13. I am focused on fun and enjoyable activities and do not bother myself with academic tasks until the last minute.
14. I intend to work on academic tasks well before the deadline, but instead of working on them I often engage in other activities without a good reason.
15. I am not interested in starting academic tasks ahead of time because I would rather do more enjoyable things instead.
16. Just before I am about to begin an intended academic task, I tend to avoid it by doing something else.
17. When academic tasks are assigned, I don't give any thought to when I will start working on them.
18. I delay on academic tasks despite the fact that I know I will feel guilty about my delay later.
19. I initially intend to not put off academic tasks, but I continuously find myself doing so.
20. When I receive academic tasks, I don't make even a vague plan to start them ahead of time.
21. I needlessly delay working on academic tasks despite the fact that I know I will not be happy about doing so later.
22. Having fun is my main priority, so I am not afraid to deliberately postpone doing academic tasks until the last minute.
23. I plan to work on academic tasks ahead of time, but when the time comes I postpone the tasks.
24. I intentionally fill my time with a lot of fun and exciting activities as opposed to planning and working on school tasks on time.
25. Despite my intention to start and finish academic tasks on time, I engage in other unnecessary activities instead.
26. When it comes to academic tasks, I don't intend to work too hard or to get started on time.
27. When I receive academic tasks, I plan to work on them ahead of time, but I needlessly delay starting them.
28. I choose to do academic tasks at the last minute so I leave more time for fun stuff instead.

29. I engage in some unnecessary activities instead of working on academic tasks based on my initial plan.
30. I plan and do fun activities (e.g., partying, going out, sports) as opposed to plan and work on academic tasks ahead of time.
31. I don't really care about starting academic tasks on time, and I intentionally do the assignments at the last minute.
32. I engage in unnecessary activities instead of working on academic tasks despite the fact that I know I will feel dissatisfied with the result of my delay later.
33. I do not care about academic tasks, and I do not plan to do them ahead of time since I have more exciting activities to do.
34. I choose to work on academic tasks at the last minute without feeling guilty about it.
35. I don't like to postpone academic tasks, but I find myself working on them near the deadline without a good reason.

-----Key for the measure of procrastination behaviour-----

Anxious procrastination= item1, item3, item5, item8, item10, item11, item12, item14, item16, item18, item19, item21, item23, item25, item27, item29, item32, item35

Hedonistic procrastination= item2, item4, item6, item7, item9, item13, item15, item17, item20, item22, item24, item26, item28, item30, item31, item33, item34

-----Section 3-----Task Reflection Questions-----

TR-Q1) When you were answering the questions related to needless delay, which academic task(s) did you have in mind? (Choose all that apply)

- ☐ Exam preparation (studying for exams)
- ☐ Writing assignment
- ☐ Assigned readings
- ☐ Writing Term paper
- ☐ Writing Essay
- ☐ Writing Thesis
- ☐ Lab report
- ☐ Illustration projects or drawing
- ☐ Problem sets
- ☐ Questions on readings or discussions
- ☐ Presentation
- ☐ Practical projects (e.g., software or game development; programming)
- ☐ Group project
- ☐ Other:-----

TR-Q1) When you were answering the questions related to needless delay, which academic task were you thinking about the most? (Only choose ONE TASK)

- ☐ Exam preparation (studying for exams)
- ☐ Writing assignment
- ☐ Assigned readings
- ☐ Writing Term paper

- Writing Essay
- Writing Thesis
- Lab report
- Illustration projects or drawing
- Problem sets
- Questions on readings or discussions
- Presentation
- Practical projects (e.g., software or game development; programming)
- Group project
- Other:-----

Appendix C

Future self-continuity

Sometimes our future selves can feel very close to us, like a good friend, or very distant as if they were a stranger. On the scale below, please indicate how similar/connected you feel to your future self at the end of the semester. Circles that overlap represent greater closeness to the future self.

1	2	3	4	5	6	7
(Not similar/connected at all)	(Not similar/connected)	(Some what not similar/connected)	(Neither similar nor not similar/connected)	(Somewhat similar/connected)	(Similar/connected)	(Completely similar/connected)

Appendix D

Positive and negative discrete emotions for future self

While imaging your future self, please indicate how often you have experienced each of the following:

0 (*never*) 1 2 3 4 (*most of the time*).

1. Amused
2. Awe
3. Content
4. Joyful
5. Grateful
6. Hopeful
7. Interested
8. Love
9. Angry
10. Contempt
11. Ashamed
12. Disgust
13. Sad
14. Scared
15. Guilty
16. Embarrassed

Appendix E

Affective empathy for future self

Please close your eyes and imagine your future self at the end of the academic semester. Rate how much you have experienced each emotion when thinking of your future self at the end of the academic semester.

1 (*not at all*) 2 3 4 5 6 7 (*Extremely*).

1. Sympathetic
2. Compassionate
3. Softhearted
4. Tender
5. Moved
6. Warm

Appendix F

Vividness of future self

Please close your eyes and imagine your future self at the end of the academic semester. Rate the vividness of the visual image, touch, smell, and sound of your future self at the end of the academic semester.

No image at all, you only 'know' that you are thinking of the object	Vague and dim	Moderately clear and vivid	Clear and reasonably vivid	Perfectly clear and as vivid as normal vision
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Appendix G

Trait vividness of mental imagery

For items 1-4, think of some relative or friend whom you frequently see (but who is not with you at present) and consider carefully the picture that comes before your mind's eye. Please rate the vividness/clarity of each mentalimage on the scale below.

No image at all, you only 'know' that you are thinking of the object	Vague and dim	Moderately clear and vivid	Clear and reasonably vivid	Perfectly clear and as vivid as normal vision
---	---------------	-------------------------------	-------------------------------	---

1. The exact contour of face, head, shoulders and body
2. Characteristic poses of head, attitudes of body, etc.
3. The precise carriage, length of step, etc., in walking
4. The different colours worn in some familiar clothes

Visualize a rising sun. Consider carefully the picture that comes before your mind's eye. Please rate the vividness/clarity of each mentalimage on the scale below.

5. The sun rising above the horizon into a hazy sky
6. The sky clears and surrounds the sun with blueness
7. Clouds. A storm blows up, with flashes of lightning.
8. A rainbow appears.

Think of a store or shop you often go to. Consider the image that comes before your mind's eye and rate the vividness/clarity of each mentalimage on the scale below.

9. The overall appearance of the shop viewed from the opposite side of the road
10. A window display including colours, shapes and details of individual items for sale
11. You are near the entrance. Think of the colour, shape and details of the door
12. You enter the shop and go to the counter. The counter assistant serves you can hands you money.

Finally, think of a country scene which involves trees, mountains and a lake. Consider the image that comes before your mind's eye and rate the vividness/clarity of each mentalimage on the scale below.

13. The contour of the landscape
14. The colour and shape of the trees
15. The colour and shape of the lake
16. A strong wind blows on the trees and on the lake, causing waves.

Appendix H

Trait empathy (affective and cognitive)

The following statements inquire about your thoughts and feelings in a variety of situations. For each item, indicate how well it describes you by choosing the appropriate number on the scale at the top of the page: 1 (Not well at all), 2, 3, 4, or 5 (Extremely well). When you have decided on your answer, select the number on the answer sheet next to the item number. READ EACH ITEM CAREFULLY BEFORE RESPONDING. Answer as honestly as you can.

1. I often have tender, concerned feelings for people less fortunate than me
2. I sometimes find it difficult to see things from the “other guy’s” point of view
3. Sometimes I don’t feel very sorry for other people when they are having problems
4. I try to look at everybody’s side of a disagreement before I make a decision
5. When I see someone being taken advantage of, I feel kind of protective towards them
6. I sometimes try to understand my friends better by imagining how things look from their perspective
7. Other people’s misfortunes do not usually disturb me a great deal
8. If I’m sure I’m right about something, I don’t waste much time listening to other people’s arguments
9. When I see someone being treated unfairly, I sometimes don’t feel very much pity for them
10. I am often quite touched by things that I see happen
11. I believe that there are two sides to every question and try to look at them both
12. I would describe myself as a pretty soft-hearted person
13. When I’m upset at someone, I usually try to “put myself in his shoes” for a while
14. Before criticizing somebody, I try to imagine how I would feel if I were in their place

Appendix I

Consent

Imagination and Future self: improving study habits with mental imagery.

Voluntary informed consent is considered a central norm governing the relationship between the investigator and the research participant. Informed consent is a legal procedure to ensure that research participants are aware of all possible risks, costs, and benefits of a psychological study in order to make an informed and voluntary decision to participate. If you are considering participating in our research, it is important for you to know that:

- *your participation is completely voluntary,*
- your responses will be kept strictly confidential and will be used for research purposes only,
- you may withdraw your participation at any time, and
- You will receive your **4% credit** if you complete all 3 parts of the study. You can withdraw from this study at any time. However if you do so, you will not be compensated with the full 4%. You will be compensated according to the proportion of the experiment that you have completed.

Please note that submission of your answers to the questionnaire will be taken as your informed, voluntary consent to participate in this research.

Introduction

Recent research has shown that our perception of future self matters in terms of the choices we make, and that imagination can influence these perceptions. In this study, we are investigating how **practicing mental imagery, or your ability to hold and manipulate images in your ‘mind’s eye’, can increase how connected you feel to your future self** and how in turn, this might **help improve your study habits now.**

What will you have to do if you agree to take part?

You will be asked to participate in a **four week online study that will require you to have full access to the Internet and to a computer that can play sound (i.e., with speakers). If you do not have a computer with speakers, you will need access to an MP3 player and/or to a cell-phone that can play iTunes compatible audio files.**

Part one of the study requires that you answer an **online questionnaire that will take approximately 1 hour** to complete. You can skip questions without penalty. This questionnaire will ask you questions about your study habits, your emotions, your perception of your future self, your ability to imagine mental pictures, and your empathy.

For part two of the study, You will be asked to **listen to a 5-8 minute audio file two times per week for four weeks in a row. You will be sent frequent e-mail reminders to listen to the audio file and imagine the situation portrayed.** Listening to the script should only take approximately a **total of 16 minutes per week over one month.**

For part three of the study, you will be sent a link to a second set of **online questionnaires that will take approximately 1 hour** to complete. You may skip questions without penalty. **You will receive a link to these questionnaires after you have completed the one-month intervention.** These questionnaires will ask you the same questions as the first set of questionnaires about your study habits, your emotions, your perception of your future self, your ability to imagine mental pictures, and your empathy. After you have completed these questionnaires, you will be shown a debriefing form explaining the full nature of the experiment, my hypotheses and why this research is important.

Participating in the entire study should take you approximately a total of 3 to 4 hours over the period of one month.

Are there any advantages of taking part?

You may find the project interesting and enjoy answering questions about the way you view yourself and the future, about your imagination, and about some of your daily school behaviours. You will also be receiving **4% of your final grade** towards your psychology course **for completing all three parts of this experiment. You will only be compensated for the portion of the experiment that you have completed if you decide to withdraw from the study.**

Are there any disadvantages of taking part?

Research about our personal lives can sometimes leave us feeling anxious, depressed or just generally upset about things. If you are feeling upset, please contact Carleton University health and counseling services by phone at 613-520-6674, or by e-mail at hcs@carleton.ca.

Anonymity/Confidentiality

We collect data through the software Qualtrics, which uses servers with multiple layers of security to protect the privacy of the data (e.g., encrypted websites and pass-word protected storage). Please note that Qualtrics is hosted by a server located in the USA. The United States Patriot Act permits U.S. law enforcement officials, for the purpose of an anti-terrorism investigation, to seek a court order that allows access to the personal records of any person without that person's knowledge. In view of this, we cannot absolutely guarantee the full confidentiality and anonymity of your data. With your consent to participate in this study you acknowledge this.

Your e-mail and student number will be required for you to participate in this study. Your personal information will be kept completely confidential and will be stored on a password protected computer. Your personal information will not be copied or shared. Only the primary investigator for this project will be able to see your information and have access to your data.

You can select 'I agree/disagree' at the end of this form to give consent to participate.

We would be happy to answer any question that may arise about the study. Please direct your questions or comments to Eve-Marie Blouin-Hudon, Masters of Psychology Candidate, Department of Psychology, evemarieblouinhudon@cmail.carleton.ca or to Dr. Timothy A. Pychyl, Department of Psychology, tim.pychyl@carleton.ca.

If you have ethical concerns, please contact Dr. Shelley Brown, Chair of the Ethics committee for Psychology research, Carleton University, shelley.brown@carleton.ca, (613-520-2600 ext 1505). For all other concerns, please contact Dr. Joanna Pozzulo, Chair of the Department of Psychology, Carleton University (613-520-2600 ext. 1412), psychchair@carleton.ca. This study has received clearance by the Carleton University Psychology Research Ethics Board (#14-191).

Appendix J

Mental imagery practice

“To prepare for this mental imagery practice session, close your eyes and relax. We will start by focusing on your breathing and on relaxing your body. Breathe in through your nose slowly. As you inhale, slowly count to five. Starting from your belly, guide your breath up through your ribs and slowly make your way to your chest. Expand your ribs and let the breath fill every part of your lungs. Pause for one second and start exhaling slowly as you once again count to five. Allow your breath to leave your chest first and make your way down to your belly. Repeat this deep inhale and exhale. Find a rhythm for your breath that you are comfortable with and focus your attention on keeping this rhythm steady and calm. Let yourself relax into your breath. When your mind wanders, and it will, gently bring your attention back to your breath and to the slow rhythm of the inhale and exhale.

Begin to imagine an apple and focus on this image. Try to see the apple from all sides. When you have a clear image of the apple, zoom in on it. Observe its skin. Is it smooth or rough? Are there any holes? Is it a green apple or a red one? Focus on these details. Now practice seeing the apple from far away, and then from very close. Take the apple in your hand and smell it. Cut it in the middle and observe the details of the exposed flesh and seeds. Observe the cut apple and see how its color darkens as time passes. Finally, cut a piece of the apple and eat it. Feel the taste on your tongue, and then on the inside of each cheek. After you are done eating the apple, take three deep breaths and open your eyes. You have now completed your first visualization exercise.”

Appendix K

Meditation condition script

“The first step is letting yourself feel the stress. Even if you’re feeling a lot of stress, really let yourself feel it. Feel the way that it contracts your body. Feel the way that it contracts your breath. Even if you need to scrunch up your face and tighten your hands up into fists and squeeze them, let yourself do that. Let yourself feel the moment to the maximum. Really feel it. And then just start breathing right into the stress. Feel where you feel the stress in your body and breathe directly into it. **Pause** Feel the stress into your face and breathe into your face. Relax your face. Feel the stress in your belly, breathe into your belly, relax your belly. Don’t try to push the energy away, don’t try to force the stress out of your body. Feel it, breathe into it and make space for it. Let the energy be as big as it wants to be inside of you, but just make as much space as it needs. Keep breathing into it, softening your body. Relax your shoulders. Breathe. Let your arms totally relax, let your hands now be completely soft. Relaxed. And breathe. Feel your chest. Feel the energy there. Let it be however it needs to be right now, but just breathe into it. relax your chest. Make space. Breathe. Scan all the way through your body from your head to your toes and see if there is anything left. Just keep breathing, releasing, relaxing. A few more breaths from the top of your head all the way down to your feet. Let go. Very good. When you’re ready, you can let your body move again, let your eyes come open again. Have a great day.”

Appendix L

Mental imagery condition script

“To prepare for this mental imagery practice session, close your eyes and relax. We will start by focusing on your breathing and relaxing your body.

Slowly breathe in through your nose. As you inhale, count to five. Starting from your belly, guide your breath up through your ribs and slowly make your way to your chest. Expand your ribs and let the breath fill every part of your lungs. Pause for one second and start exhaling slowly as you once again count to five. Allow your breath to leave your chest first and make your way down to your belly. Repeat this deep inhale and exhale. Find a rhythm for your breath that you are comfortable with and focus your attention on keeping this rhythm steady and calm. Let yourself relax into your breath. When your mind wanders, and it will, gently bring your attention back to the slow and steady rhythm of your breath.

When you feel relaxed, begin to picture your future self at the end of the semester standing a few feet away from you. Now look at the room around you. Is it a quiet or a loud space? Is it bright or dark? Is it night or day? You notice that your future self is holding a textbook and is opening it to read. Pay close attention to the book. Does it look brand new or has it been used often? You look around and see more textbooks, articles, and notebooks from your other classes stacked around your future self. Are the articles highlighted or left blank? Have the notebooks been used often or do they look unused?

You now pay attention to your future self’s face and body. What is your future self wearing? You notice a few of your class outlines with deadlines for readings, assignments and exams beside your future self and you can tell that the end of the semester brings with it many challenges and uncertainties. How do you think your future self feels? Is your future self prepared for this time of year?

You now see your future self turning on a nearby computer, logging onto the Carleton University Portal, and opening up the final exam schedule for each class. You now bring your gaze to the final exam schedule on the computer screen. You notice that there is quite a lot of work to be done in a short amount of time. Look closely at your future self’s facial expression once again. What has your future self done during the semester to prepare for these exams?

After a few minutes, you see your future self opening and reading an e-mail that talks about plans for once exams are done. What do these plans involve? How do you think your future self feels when thinking of these plans? After a period of time, you look over and see that your future self is done reading and is now opening up a text editor on the computer. You see your future self glance over at a notebook and read the notes for a final written assignment that is due in a few days. You see your future self start to write paragraphs of the final assignment. Does it look like the assignment is almost finished or is there still a lot to be done?

Let’s shift the perspective. Begin to picture yourself inside the body of your future self at the end of the semester. You can now see through your future self’s eyes. Look at the palms of your hands, and then look around the room. Is it quiet or loud ? Bright or dark ? Is it daytime or nighttime ? You notice that you are holding a textbook from one of your classes. What does the textbook look like? You look around and notice a few course outlines from your classes scattered

around you. Seeing the deadlines reminds you that you are preparing for upcoming final exams. It's a busy time of year at school. How do you feel?

You notice that your heart is beating faster than usual. You decide to fill your lungs with a deep breath of air that you exhale very slowly. You notice that breathing deeply a few times slows down your heartbeat. When you feel more relaxed, you open the book that is in your hands. Does the spine of the book make a loud crack when you open it, or is it very flexible, like it has been opened many times? Have you highlighted or made notes on the pages or are they completely white? Are you reading the text for the first time or are you familiar with it?

Remember, you are inside your future self's body. You now start to read the text out loud. When you read your text, is your voice loud or is it soft spoken? Does it sound monotone or can you hear certain emotions? Do you find the reading boring or interesting? Now flip through the pages of the book. What do they smell like? Touch the pages with your fingers. Are they rough or smooth? Is the book heavy or very light?

Now picture yourself closing the book and storing it away in a bag. You take out a notebook from the bag and sit down at a nearby computer to work on a final written assignment. What does your notebook look like? Look up at the computer. What does it look like? When you place your fingers on the keyboard, what do the keys feel like? You now begin to write paragraphs for your final assignment due in a few days. Try to see the words that you are typing. Is the assignment almost done or are you just starting it now? How do you feel when you are writing this final assignment?

After a period of time, you notice an e-mail in your inbox. You take the mouse with your hand and click to open the e-mail. You notice that the e-mail contains your exam and assignment schedule. Looking over the schedule, you realize how busy the next few weeks will be. How do you feel when reading this e-mail? Are you prepared for finals? A new e-mail appears in your inbox. You open it and read about your plans for after final exams –which means time spent away from campus and the demands of your studies. How do you feel when thinking about these plans?

Now picture your hands turning off the computer and closing the notebook.

You will now be leaving your future self's body and return to your present self. Bring your attention back to your breath. Start making your breath deeper and slower. Once you are ready, you may start moving your fingers and your toes and open your eyes. The exercise is now completed."

Appendix M

Implementation intention

Please **keep a copy of when and where you plan to practice your script this week** close by, or **write it down on your weekly calendar**. Please listen to your script at a quiet time of the day when you are at home and/or by yourself, and follow the relaxation and closed-eye instructions at the beginning of the audio file.

1. Please indicate **when** (i.e., time of day) you plan on practicing your imagery script/relaxation script this week. Remember, you should practice the script **twice this week**:
2. Please indicate **where** (i.e., living room, bedroom) you plan on practicing your script this week. Remember, you should practice the script **twice this week**:

Appendix N

Manipulation check

1. Please indicate the time of day that you practiced your script:
2. Please indicate where you practiced your script:

Appendix O

Experimentalcondition Debriefing

Thank you for participating in our study!

As part of the ethical conduct of research, we do our best to ensure that no research participants are harmed in any way. Apart from the actual design of the data collection, we address this issue of harm with this written "debriefing." Please take time now to read the information on this page.

We used mild deception in the present study because it was stated in the recruitment form and the consent form that you will partake in a study of your "*study habits*" and mentions assessing the delay of everyday tasks instead of explicitly stating that the study was designed to help you reduce *academic procrastination*. This mild deception was used in order to get your natural response to procrastination behaviours and so as not to bias you to reduce procrastination simply because that was our intention.

Most of the research on procrastination has been conducted by looking at how people delay tasks in the present. So far, research has found that people who procrastinate rarely think of the future and focus primarily on the present. Although research has demonstrated that people who are less connected to their future self save less for retirement and make more unethical decisions, little research has examined how feeling more connected to your future self can reduce procrastination.

Interestingly, a separate line of research has shown that being able to mentally picture/imagine another person increases emotions and empathy for the person that is being imagined (i.e., feel more connected to that person). Knowing this, we hypothesized that consistently practicing the mental imagery script over one month would increase the clarity/vividness of your future self and that this would increase your emotional and empathetic connection to that future self (like increasing your connection to another person). As a result of feeling more emotionally connected to your future self at the end of the academic semester, we hypothesized that you will procrastinate less. We hypothesized this because if you feel more empathetic and connected to your future self, you are less likely to want to delay tasks that will increase stress and anxiety (i.e., make *yourself* feel worse) at the end of the semester.

In sum, the assumption in our study was that if you feel like your future self is a direct extension of who you are today, you will want to take the measures today (i.e., procrastinate less) in order to feel better at the end of the semester (i.e., during final exams/projects). Since you were part of the experimentalcondition, we had you practice mental imagery of your future self in order to see if this is true.

If you would like to have access to a five-minute stress-reducing meditation script, please contact Eve-Marie Blouin-Hudon, Masters of Psychology Candidate, Department of Psychology, evemarieblouinhudon@cmail.carleton.ca, or Dr. Timothy A. Pynchyl, Department of Psychology, tim.pynchyl@carleton.ca.

If you have ethical concerns please contact Dr. Shelley Brown, Chair of the Ethics committee for Psychology research, Carleton University, shelley.brown@carleton.ca, (613-520-2600 ext 1505). For all other concerns, please contact Dr. Joanna Pozzulo, Chair of the Department of Psychology, Carleton University (613-520-2600 ext. 1412), psychchair@carleton.ca.

If you feel any distress or anxiety after participating in this study, please feel free to contact the Carleton University Health and Counseling Services at: 613-520-6674, or the Distress Centre of Ottawa and Region at 613-238-3311 (<http://www.dcottawa.on.ca>).

If you are interested in learning more about procrastination, you could access Dr. Pychyl's research website at procrastination.ca. Dr. Pychyl is also the host of an academic podcast where he interviews social/personality scientists and philosophers from around the world on the topic of procrastination. If you would like to know more about our research connecting mental imagery, self-continuity and the future self with procrastination, you can listen to Dr. Pychyl's iProcrastinate podcast on Future Self at <http://iprocrastinate.libsyn.com/future-self>

Thanks again for your participation. We remind you that we would be happy to answer any question that may arise about the study.

This study has received clearance by the Carleton University Psychology Research Ethics Board (#14-191).

Appendix P

Control condition Debriefing

Thank you for participating in our study!

As part of the ethical conduct of research, we do our best to ensure that no research participants are harmed in any way. Apart from the actual design of the data collection, we address this issue of harm with this written "debriefing." Please take time now to read the information on this page.

We used mild deception in the present study because it was stated in the recruitment form and the consent form that you will partake in a study of your "*study habits*" and mentions assessing the delay of everyday tasks instead of explicitly stating that the study was designed to help you reduce *academic procrastination*. This mild deception was used in order to get your natural response to procrastination behaviours and so as not to bias you to reduce procrastination simply because that was our intention.

Most of the research on procrastination has been conducted by looking at how people delay tasks in the present. So far, research has found that people who procrastinate rarely think of the future and focus primarily on the present. Although research has demonstrated that people who are less connected to their future self save less for retirement and make more unethical decisions, little research has examined how feeling more connected to your future self can reduce procrastination.

Interestingly, a separate line of research has shown that being able to mentally picture/imagine another person increases emotions and empathy for the person that is being imagined (i.e., feel more connected to that person). Knowing this, we hypothesized that consistently practicing the mental imagery script over one month would increase the clarity/vividness of future self and that this would increase the emotional and empathetic connection to that future self (like increasing the connection to another person). As a result of feeling more emotionally connected to future self at the end of the academic semester, we hypothesized that participants in the experimental condition (i.e., who listened to the mental imagery script) will procrastinate less. We hypothesized this because if they feel more empathetic and connected to their future self, they are less likely to want to delay tasks that will increase stress and anxiety at the end of the semester.

In sum, the assumption in our study was that if you feel like your future self is a direct extension of who you are today, you will want to take the measures today (i.e., procrastinate less) in order to feel better at the end of the semester (i.e., during final exams/projects). Since you were part of the control condition, we had you practice a stress-reducing meditation. Meditation can reduce procrastination because it allows you to calm down and lowers the arousal of your nervous system. However, you were part of this group so that we could compare if participants in the experimental group (i.e., those who practiced mental imagery to increase their connection to their future self) reduced

their procrastination behaviours even more than participants in your group (i.e., who meditated). This will allow us to determine if mental imagery is a good tool for procrastination intervention.

If you would like to have access to an 8 minute mental imagery audio file about your future self at the end of the semester, please contact Eve-Marie Blouin-Hudon, Masters of Psychology Candidate, Department of Psychology, evemarieblouinhudon@email.carleton.ca, or Dr. Timothy A. Pychyl, Department of Psychology, tim.pychyl@carleton.ca.

If you have ethical concerns please contact Dr. Shelley Brown, Chair of the Ethics committee for Psychology research, Carleton University, shelley.brown@carleton.ca, (613-520-2600 ext 1505). For all other concerns, please contact Dr. Joanna Pozzulo, Chair of the Department of Psychology, Carleton University (613-520-2600 ext. 1412), psychchair@carleton.ca.

If you feel any distress or anxiety after participating in this study, please feel free to contact the Carleton University Health and Counseling Services at: 613-520-6674, or the Distress Centre of Ottawa and Region at 613-238-3311 (<http://www.dcottawa.on.ca>).

If you are interested in learning more about procrastination, you could access Dr. Pychyl's research website at procrastination.ca. Dr. Pychyl is also the host of an academic podcast where he interviews social/personality scientists and philosophers from around the world on the topic of procrastination. If you would like to know more about our research connecting mental imagery, self-continuity and the future self with procrastination, you can listen to Dr. Pychyl's iProcrastinate podcast on Future Self at: <http://iprocrastinate.libsyn.com/future-self>

Thanks again for your participation. We remind you that we would be happy to answer any question that may arise about the study.

This study has received clearance by the Carleton University Psychology Research Ethics Board (#14-191).

Appendix Q

SAS Syntax

```

proc import datafile = 'P:\EveThesis\Thesis Data\MasterDataSAS.sav' out = MasterData
dbms = sav replace;
run;
proc print data=MasterData;
run;

data EveMasterData; set MasterData;
    array F1 [3] FSC1-FSC3;
    array FV1 [3] FS_Vivid1-FS_Vivid3;
    array I1 [3] DispImagery1-DispImagery3;
    array EP1 [3] FSPosDisEm1-FSPosDisEm3;
    array EN1 [3] NegDisEmFS1-NegDisEmFS3;
    array EEC1 [3] TraitEmp_EC1-TraitEmp_EC3;
    array EPT1 [3] TraitEmp_PT1-TraitEmp_PT3;
    array TEP1 [3] TraitEmp1-TraitEmp3;
    array FE1 [3] FS_AffEmp1-FS_AffEmp3;
    array PTI1 [3] ProcTI1-ProcTI3;
    array PTD1 [3] ProcTD1-ProcTD3;
    array PID1 [3] ProcAnxious1-ProcAnxious3;
    array PHD1 [3] ProcHedonistic1-ProcHedonistic3;
    array PT [3] ProcTotal1-ProcTotal3;
    do t = 1 to 3;
        FSC = F1[t];
        FSVivid = FV1[t];
        DispIma = I1[t];
        FSPA = EP1[t];
        FSNA = EN1[t];
        EmpEC = EEC1[t];
        EmpPT = EPT1[t];
        DispEmp = TEP1[t];
        FSEmp = FE1[t];
        ProcTI = PTI1[t];
        ProcTD = PTD1[t];
        ProcIrra = PID1[t];
        ProcHed = PHD1[t];
        ProcTotal = PT[t];
        time = t-1;
        output;
        end;
        keep ImaCtrl time id Name DispEmp FSC FSVivid DispIma FSPA FSNA
EmpEC EmpPT FSEmp ProcTI ProcTD ProcIrra ProcHed ProcTotal Sex ImaMedi;
run;

```



```

***Ok dataset is officially created to support growth latent model;
proc print data=EveMasterData;
run;

*****Creating main datafile with all centered
variables*****;
data FSpM; set EveMasterData;
    FSEmppc=FSEmp;
    FSVividpc=FSVivid;
    FSPApc=FSPA;
    FSNApc=FSNA;
    FSCpc=FSC;
    EmpPTpc=EmpPT;
run;
proc standard data=FSpM m=0 out=FSVividpc;
    by id;
    var FSVividpc;
run;
proc standard data=FSVividpc m=0 out=FSEmppc;
    by id;
    var FSEmppc;
run;
proc standard data=FSEmppc m=0 out=FSPApc;
    by id;
    var FSPApc;
run;
proc standard data=FSPApc m=0 out=FSNApc;
    by id;
    var FSNApc;
run;
proc standard data=FSNApc m=0 out=FSCpc;
    by id;
    var FSCpc;
run;
proc standard data=FSCpc m=0 out=FSPC;
    by id;
    var EmpPTpc;
run;
proc means data=EveMasterData noprint;
    by id;
    var FSVivid;
    output out=FSVividm mean=mFSVivid;
run;
data FSVividM; merge FSPC FSVividm;
    by id;
run;

```

```

proc standard data=FSVividM m=0 out=FSVividC;
    var mFSVivid;
run;
data FSVividmerged ; merge FSPC FSVividC;
run;
proc means data=EveMasterData noprint;
    by id;
    var FSEmp;
    output out=FSM mean=mFSEmp;
run;
data FSMM; merge FSM FSVividmerged;
    by id;
run;
proc standard data=FSMM m=0 out=FSEmpC;
    var mFSEmp;
run;
data FSEmpmerged ; merge FSPC FSEmpC;
run;
proc means data=EveMasterData noprint;
    by id;
    var FSPA;
    output out=FSPAm mean=mFSPA;
run;
data FSPAM; merge FSPAm FSEmpmerged;
    by id;
run;
proc standard data=FSPAM m=0 out=FSPAC;
    var mFSPA;
run;
data FS ; merge FSPC FSPAC;
run;
proc means data=EveMasterData noprint;
    by id;
    var FSNA;
    output out=FSNAmean mean=mFSNA;
run;
data FSNAmean; merge FSNAmean FS;
    by id;
run;
proc standard data=FSNAmean m=0 out=FSNAC;
    var mFSNA;
run;
data FSNAC ; merge FSPC FSNAC;
run;
proc means data=EveMasterData noprint;
    by id;

```

```

        var FSC;
        output out=FSCm mean=mFSC;
run;
data FSCmerge; merge FSCm FSCFINAL;
    by id;
run;
proc standard data=FSCmerge m=0 out=FSCc;
    var mFSC;
run;
data FSmFINAL ; merge FSPC FSCc;
run;
proc means data=EveMasterData noprint;
    by id;
    var EmpPT;
    output out=EmpPTm mean=mEmpPT;
run;
data EmpPTmerge; merge EmpPTm FSmFINAL;
    by id;
run;
proc standard data=EmpPTmerge m=0 out=EmpPTc;
    var mEmpPT;
run;
data FSallFINAL ; merge FSPC EmpPTc;
run;

*****Procrastination
model*****;
*Unconditional (no predictors) chunk;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model ProcTotal = time /ddfm=bw solution;
    random intercept /subject=id type=un;
run;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model ProcTotal = time/ddfm=bw solution;
    random intercept time/subject=id type=un;
run;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model ProcTotal = time FSCpc /ddfm=bw solution;
    random intercept time FSCpc/subject=id type=un;
run;*Variance of random slope (FSCpc is not significant, so should be fixed);
*Model 1;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;

```

```

        model ProcTotal = time FSCpc /ddfm=bw solution;
        random intercept time /subject=id type=un;
run;
*Model 2;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model ProcTotal = time FSCpc mFSC /ddfm=bw solution;
    random intercept time /subject=id type=un;
run;
*Model 3 ;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model ProcTotal = time FSCpc mFSC time*FSCpc /ddfm=bw solution;
    random intercept time /subject=id type=un;
run;
*Model 4;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model ProcTotal = time FSCpc mFSC time*FSCpc time*mFSC /ddfm=bw
solution;
    random intercept time /subject=id type=un;
run;
*****I found group differences in perspective taking...*****;
*Model 1;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model EmpPT = time /ddfm=bw solution;
    random intercept /subject=id type=un;
run;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model EmpPT = time /ddfm=bw solution;
    random intercept time /subject=id type=un;
run;
*Model 2;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model EmpPT = time ImaMedi/ddfm=bw solution;
    random intercept time /subject=id type=un;
run;
*Model 3;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model EmpPT = time ImaMedi time*ImaMedi /ddfm=bw solution;
    random intercept time /subject=id type=un;
    estimate 'Imagery intercept' intercept 1 ImaMedi -.5;

```

```

        estimate 'Imagery slope' time 1 time*ImaMedi -.5;
        estimate 'Meditation intercept' intercept 1 ImaMedi .5;
        estimate 'Meditation slope' time 1 time*ImaMedi .5;
run; *Significant...;
**Plot significant EmpPT*ImaMedi interaction***;
data EmpPTplot; *this is based on nothing so no set statement;
    do time = 0 to 2;
        Imagery = 3.5281 + .1464 + (.08157+.09191)*time;
        Meditation = 3.5281 + .08157*time;
    output;
    end;
run;
proc gplot data=EmpPTplot;
    plot Imagery*time Meditation*time /overlay legend=legend1 vaxis=axis1;
    *symbol1 command will apply to GPA1 and so on; *overlay or else will make 3 different
    plots;
run;
goption reset=all hsize=7 vsize=5;
    symbol1 value=none i=join color=Black;
    symbol2 value=none i=join color=Grey40 line=2;
    title 'Empathy (perspective taking) growth by Condition';
    legend1 frame label=none shape=symbol(.5,.2)CM
        value=("Imagery" "Meditation");
    axis1 label=(angle=90 "EmpPT");
run;

****EmpPT and FSC as predictors of proc growth***;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model ProcTotal = time ImaMedi EmpPTpc mEmpPT EmpPTpc*time
mEmpPT*time FSCpc mFSC time*FSCpc time*mFSC ImaMedi*EmpPTpc
ImaMedi*mEmpPT ImaMedi*mFSC ImaMedi*FSCpc ImaMedi*time/ddfm=bw
solution;
    random intercept time /subject=id type=un;
    estimate 'Hi EmpPTpc intercept' intercept 1 EmpPTpc .270;
    estimate 'Hi EmpPTpc slope' time 1 time*EmpPTpc .270;
    estimate 'Lo EmpPTpc intercept' intercept 1 EmpPTpc -.270;
    estimate 'Lo EmpPTpc slope' time 1 time*EmpPTpc -.270;
run;
**Plot significant EmpPT*time interaction***;
data EmpPTProcplot; *this is based on nothing so no set statement;
    do time = 0 to 2;
        LOEmpt = 2.9958 -.09188*time + .4830*-.270 -.2736*time*-.270;
        HiEmpt = 2.9958 -.09188*time + .4830*.270 -.2736*time*.270;
    output;
    end;

```

```

run;
proc gplot data=EmpPTProcplot;
    plot LoEmpt*time HiEmpt*time /overlay legend=legend1 vaxis=axis1;
    *symbol1 command will apply to GPA1 and so on; *overlay or else will make 3 different
    plots;
run;
goption reset=all hsize=7 vsize=5;
    symbol1 value=none i=join color=Black;
    symbol2 value=none i=join color=Gray40 line=2;
    title 'Proc growth by Empathy (Perspective taking)';
    legend1 frame label=none shape=symbol(.5,.2)CM
        value=("LoEmpPT" "HiEmpPT");
    axis1 label=(angle=90 "Proc");
run;

****Gender differences****;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model FSC = time Sex FSEmpppc FSEmpppc*Sex mFSEmp mFSEmp*Sex
/solution ddfm=bw;
    random intercept time /subject=id type=un;
run; *Ok no gender differences;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model FSC = time Sex time*Sex /solution ddfm=bw;
    random intercept time /subject=id type=un;
run; *no;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model FSEmp = time Sex time*Sex /solution ddfm=bw;
    random intercept time /subject=id type=un;
run; *no;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model ProcTotal = time Sex time*Sex /solution ddfm=bw;
    random intercept time /subject=id type=un;
run; *no;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model FSVivid = time Sex time*Sex /solution ddfm=bw;
    random intercept time /subject=id type=un;
run; *no;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model EmpPT = time Sex time*Sex /solution ddfm=bw;
    random intercept time /subject=id type=un;

```

```

run;*no;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model EmpEC = time Sex time*Sex /solution ddfm=bw;
    random intercept time /subject=id type=un;
run;*no;

*****FSC GENERAL*****
*Unconditional model growth model;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model FSC = time/solution ddfm=bw;
    random intercept /subject=id;
run;
*Adding time as level 1 predictor randomly varying ;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model FSC = time /solution ddfm=bw;
    random intercept time /subject=id type=un;
run;
*Adding in Condition;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model FSC = time ImaMedi/solution ddfm=bw;
    random intercept time /subject=id type=un;
run;
*ImaMedi*time interaction;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model FSC = time ImaMedi time*ImaMedi /solution ddfm=bw;
    random intercept time /subject=id type=un;
run; *no differences in FSC growth by condition;
*****FSC putcome + FSVivid +EmpPT + FSEmp preds model + all traits
controlled*****;
proc mixed data=FSallFINAL method=reml noclprint covtest;
    class id;
    model FSC = time ImaMedi DispIma EmpEC FSVividpc mFSVivid
time*mFSVivid time*FSVividpc ImaMedi*FSVividpc EmpPTpc mEmpPT
ImaMedi*time time*mEmpPT time*EmpPTpc ImaMedi*EmpPTpc FSEmpcpc mFSEmp
time*FSEmpcpc time*mFSEmp ImaMedi*FSEmpcpc/ddfm=bw solution;
    random intercept time FSVividpc /subject=id type=un;
    estimate 'Hi FSVividpc intercept' intercept 1 FSVividpc .664;
    estimate 'Hi FSVividpc slope' time 1 time*FSVividpc .664;
    estimate 'Lo FSVividpc intercept' intercept 1 FSVividpc -.664;
    estimate 'Lo FSVividpc slope' time 1 time*FSVividpc -.664;
    estimate 'Hi EmpPTpc intercept' intercept 1 EmpPTpc .270;

```

```

estimate 'Hi EmpPTpc slope' time 1 time*EmpPTpc .270;
estimate 'Lo EmpPTpc intercept' intercept 1 EmpPTpc -.270;
estimate 'Lo EmpPTpc slope' time 1 time*EmpPTpc -.270;
estimate 'Hi FSEmpcpc intercept' intercept 1 FSEmpcpc .673;
estimate 'Hi FSEmpcpc slope' time 1 time*FSEmpcpc .673;
estimate 'Lo FSEmpcpc intercept' intercept 1 FSEmpcpc -.673;
estimate 'Lo FSEmpcpc slope' time 1 time*FSEmpcpc -.673;
run;
*EmpPTpc*time interaction is significant, but it has the reverse effect that I would
expect. I'm going to try all 3
predictors in their own FSC as outcome model to see if this still holds;
*Emppt on FSC;
proc mixed data=FSallFINAL method=reml noclprint covtest;
  class id;
  model FSC = time ImaMedi EmpPTpc mEmpPT time*mEmpPT time*EmpPTpc
/ddfm=bw solution;
  random intercept time /subject=id type=un; *I can't let EmpPTpc randomly vary.;
run;
run;*Non significant. EmpPT is not that highly correlated with other FSVivid and
FSEmp, but the reversal may still be due
to this...;
*FSEmp on FSC;
proc mixed data=FSallFINAL method=reml noclprint covtest;
  class id;
  model FSC = time ImaMedi EmpEC FSEmpcpc mFSEmp time*FSEmpcpc
time*mFSEmp /ddfm=bw solution;
  random intercept time FSEmpcpc /subject=id type=un;
run;*Very marginally significant, but not strong enough to withstand bonferroni;
*FSVivid on FSC;
proc mixed data=FSallFINAL method=reml noclprint covtest;
  class id;
  model FSC = time DispIma ImaMedi FSVividpc mFSVivid time*mFSVivid
time*FSVividpc /ddfm=bw solution;
  random intercept time FSVividpc /subject=id type=un;
run;*Good, strongest predictor of FSC growth through time;*This is the one that I feel
most confident to talk about;
*Probe FSVividpc*time interaction;
goption reset=all hsize=7 vsize=5;
symbol1 value=none i=join color=Black;
symbol2 value=none i=join color=Gray40 line=2;
title 'FSC growth by Vividness of Future Self (person centered)';
legend1 frame label=none shape=symbol(.5,.2)CM
  value=("Lo FSVividpc" "Hi FVividpc");
axis1 label=(angle=90 "FSC");
run;
data FSVividplot;

```



```

do time = 0 to 2;
LOmFSVivid = 4.195 + .235*time + .208*-.664 + .206*time*-.664;
HimFSVivid = 4.195 + .235*time + .208*.664 + .206*time*.664;
output;
end;
run;
proc gplot data=FSVividplot;
plot LOmFSVivid*time HimFSVivid*time /overlay legend=legend1
vaxis=axis1;
run;

***FSVivid growth by group?****;
proc mixed data=EveMasterData method=reml noclprint covtest;
class id;
model FSVivid = time ImaMedi time*ImaMedi/solution ddfm=bw;
random intercept time /subject=id type=un;
run;

***FSEmp growth by group?****;
proc mixed data=EveMasterData method=reml noclprint covtest;
class id;
model FSEmp = time ImaMedi time*ImaMedi/solution ddfm=bw;
random intercept time /subject=id type=un;
run;

***EmpEC growth by group?****;
proc mixed data=EveMasterData method=reml noclprint covtest;
class id;
model EmpEC = time ImaMedi time*ImaMedi/solution ddfm=bw;
random intercept time /subject=id type=un;
run;

***DispIma growth by group?****;
proc mixed data=EveMasterData method=reml noclprint covtest;
class id;
model DispIma = time ImaMedi time*ImaMedi/solution ddfm=bw;
random intercept time /subject=id type=un;
run;

**Lets try plotting with non-parametric Loess curve***;

ods graphics on / width=8in border=off;
proc sgplot data=EveMasterData ;
loess y=ProcTotal x=time /group=ImaCtrl nomarkers ;
yaxis max=6 min=0;

```

```
        title 'Proc growth by condition';
run;

ods graphics on / width=8in border=off;
proc sgplot data=EveMasterData ;
    loess y=FSC x=time /group=ImaCtrl nomarkers;
    yaxis max=7 min=0;
    title 'FSC growth by Condition';
run;
title;

ods graphics on / width=8in border=off;
proc sgplot data=EveMasterData ;
    loess y=FSEmp x=time /group=ImaCtrl nomarkers;
    yaxis max=6 min=0;
    title 'Empathy for FS growth by Condition';
run;
title;

ods graphics on / width=8in border=off;
proc sgplot data=EveMasterData ;
    loess y=FSPA x=time /group=ImaCtrl nomarkers;
    yaxis max=7 min=0;
    title 'Positive emotions for FS growth by Condition';
run;
title;

ods graphics on / width=8in border=off;
proc sgplot data=EveMasterData ;
    loess y=FSNA x=time /group=ImaCtrl nomarkers;
    yaxis max=7 min=0;
    title 'Negative emotions for FS growth by Condition';
run;
title;

ods graphics on / width=8in border=off;
proc sgplot data=EveMasterData ;
    loess y=FSVivid x=time /group=ImaCtrl nomarkers;
    yaxis max=5 min=0;
    title 'Vividness of FS growth by Condition';
run;
title;

ods graphics on / width=8in border=off;
proc sgplot data=EveMasterData ;
```

```
      loess y=EmpEC x=time /group=ImaCtrl nomarkers;  
      yaxis max=7 min=0;  
      title 'Trait Empathy (Empathetic concern) growth by Condition';  
run;  
title;  
  
ods graphics on / width=8in border=off;  
proc sgplot data=EveMasterData ;  
      loess y=EmpPT x=time /group=ImaCtrl nomarkers;  
      yaxis max=7 min=0;  
      title 'Trait Empathy (Perspective taking) growth by Condition';  
run;  
title;  
  
ods graphics on / width=8in border=off;  
proc sgplot data=EveMasterData ;  
      loess y=Displma x=time /group=ImaCtrl nomarkers;  
      yaxis max=7 min=0;  
      title 'Trait Imagery Vividness growth by Condition';  
run;  
title;
```

Appendix R

Figure 5. Non-parametric Loess curve for affective empathy for future self (FSEmp) change across time by condition.