

Approach Motivation Gives Rise to Meaning in Life

by

Abdelrahman Elnakouri

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## Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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## Abstract

Coherence, purpose, and significance have emerged as the three contributors to meaning in life. Current theories have primarily emphasized coherence as key to meaning, neglecting purpose and significance. A theoretical perspective is posited which argues that approach motivation integrates all three contributors and gives rise to meaning through feelings of self-regulatory success. The present thesis therefore tested whether approach motivation uniquely contributes to meaning over and above the previously emphasized coherence, which acts to maintain meaning by preventing inhibition. Studies 1a, 2a, and 3a found that measures of approach motivation better predicted meaning compared to inhibition. Study 1b found that variants of the dopamine receptor D4 (DRD4) gene associated with increased approach motivation predicted meaning and that this relationship was mediated by approach motivation, but not inhibition. In Study 1c, a between-subjects manipulation of approach motivation led to increased meaning relative to a control condition. In Studies 2b and 3b, within-subject manipulations of approach motivation and significant values led to increased meaning. Elevations in state approach motivation, but not changes in state inhibition, consistently mediated within-subjects effects on meaning. The potential relationship between happiness and meaning is discussed.

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## CHAPTER 1: INTRODUCTION

The subjective experience of meaning in life appears to be vital for healthy psychological function. It predicts well-being across the lifespan (Reker, Peacock, & Wong, 1987), capacity to cope with challenges and traumas (Park & Baumeister, 2016; Updegraff, Silver, & Holman, 2008), lower risk for mortality (Boyle, Barnes, Buchman, & Bennett, 2009), low depression (Mascaro & Rosen, 2005), low drug use (Harlow, Newcomb, & Bentler, 1986), freedom from loneliness (Stillman et al., 2009), and freedom from physical ailments (Kim, Sun, Park, & Peterson, 2013; Krause, 2004; Pinquart, 2002; Taylor, 1993). Indeed, even after controlling for demographics and other aspects of psychological and affective well-being, meaning predicted less mortality 14 years after the baseline measure (Hill & Turiano, 2014).

Despite a recent flurry of empirical interest over the past 20 years with some promising progress, an integrated theoretical account of meaning in life has yet to emerge (for reviews, see George & Park, 2016; Martela & Steger, 2016). Recent theories have emphasized coherence, a sense that one is free of inhibition and anxiety, as the key contributor to meaning (Heine, Proulx, & Vohs, 2006; Heintzelman & King, 2014a; Heintzelman, Trent, & King, 2013). Other work focuses on purpose, positive affect, and effective action in life (Baumeister, 1991; King, Hicks, Krull, & Del Gaiso, 2006; Steger, Frazier, Oishi, & Kaler, 2006). Still others have focused on values and ideals that provide feelings of ultimate significance (Arndt, Landau, Vail III, & Vess, 2013; Huta & Ryan, 2010; Keyes, Shmotkin, & Ryff, 2002). Recent literature reviews have accordingly identified coherence, purpose, and significance as the three contributors to meaning (George & Park, 2016; Martela & Steger, 2016). However, there is yet to be a theoretical account of meaning in life which integrates coherence, seen as the key contributor, with purpose and significance.

Following recent work linking meaning with self-regulation and eager optimism (Van Tilburg & Igou, 2018; Van Tongeren et al., 2018; Vazeou-Nieuwenhuis, Orehek, & Scheier, 2017), I considered whether coherence, purpose, and significance might contribute to meaning by either enhancing or hindering self-regulation. Specifically, this self-regulatory perspective posits that people experience meaning when they feel like they're approaching valued and worthy goals in their life, free from inhibition. Incoherence can lead to inhibition and anxiety, which in turn hinders self-regulation and approach motivation (Corr & Krupić, 2017; Jonas et al., 2014; Proulx, Inzlicht, & Harmon-Jones, 2012). Moreover, exposure to coherence and structure has been shown to enhance approach motivation (Kay, Laurin, Fitzsimons, & Landau, 2014). Similarly, purpose and significance have been associated with approach motivation in past research (Amodio, Shah, Sigelman, Brazeal, & Harmon-Jones, 2004; Carver & Scheier, 1998; McGregor, Prentice, & Nash, 2012; Urry et al., 2004) and approach motivation is linked to feelings of vitality, hope, optimism and joy, which are similar in tone to the kinds of affects that have been linked to meaning in life (Feldman & Snyder, 2005; Harmon-Jones, Bastian, & Harmon-Jones, 2016; King et al., 2006; Steger et al., 2006; van Tilburg & Igou, 2018).

Therefore, the emphasis on coherence as the key contributor to meaning might be incomplete. Incoherence may lead to inhibition, which hinders self-regulation, but a full view of meaning in life likely involves approach motivation, which is associated with and helps integrate all three contributors. Accordingly, in three studies, I test whether approach motivation predicts meaning, over and above contributions from inhibition, and whether experimental manipulations of approach motivation will increase meaning.

## Experiencing Meaning in Life

In an attempt to establish meaning as a subject of study, early researchers formulated the following question: "What are the conditions under which an individual will experience [her/]his life as meaningful?" (Battista & Almond, 1973, p. 423). This is precisely the question that this paper seeks to address and not the philosophical question of whether there is any meaning "out there." Moreover, this distinction between experienced meaning and meaning "out there" does not seem to be something lay people recognize. Study 2a found that trait and state levels of how often people *felt* like their life was meaningful were correlated at .72 with measures of their life actually being meaningful. All measures also loaded onto one meaning factor with loadings of .85 or above. Therefore, for the remainder of this paper "meaning" will describe people's experience of meaning in life.

So what gives rise to meaning? The word meaning often refers to what something signifies, and so the meaning *of life* likely involves thinking about what life, as a whole, signifies. I propose that when people consider what their life as a whole signifies, they think about their ultimate values. Significance will then come from the degree to which they feel like their life is approaching and exemplifying these values. In effect, people are substituting "Is my life meaningful?" with "Is my life, as a whole, approaching and exemplifying a value that I deem to be significant?". From this perspective, the type of value (e.g., hedonic, communal, achievement, self-advancement) can vary (see McGregor & Little, 1998 for evidence of meaning derived from disparate value priorities; but see also Wong, 1998 for evidence that relationships, achievement, and religion are normative themes). To answer affirmatively, people will also need goals that help them move towards these values (purpose) as well as a clear, uninhibited view of how to get there (coherence).

Consistent with the idea that people reflect on their whole lives when considering meaning, Baumeister, Vohs, Aaker, and Garbinsky (2013) found thinking about life over time to be a unique quality of meaning, “One crucial advantage of meaning is that it is not limited to the immediately present stimulus environment. Meaningful thought allows people to think about past, future, and spatially distant realities (and indeed even possibilities). Related to that, meaning can integrate events across time.” (p. 506). Moreover, increased connectivity in brain areas responsible for prospection and retrospection are correlated with meaning and manipulating the ability to construct distal events bolsters meaning in life (Waytz, Hershfield, & Tamir, 2015), suggesting that people who more readily think about their lives over time experience a greater sense of meaning.

Given the difficulties in characterizing the complexities of an entire life with momentary judgments, I propose that people use their experiential motivational state as information about meaning (Heintzelman & King, 2014a). Approach motivation related feelings of enthusiasm, hope, and optimism for the future will be heuristically used to inform the question of whether one’s life is successfully approaching a significant value (see Schwarz & Clore, 2003, for evidence that people use mood as information when making complex judgments about general states). Similarly, feelings of inhibition, anxiety, and uncertainty will work against an optimistic life outlook. Therefore, all three contributors (coherence, purpose, and significance) will influence approach motivation, which will in turn give rise to meaning.

This theoretical analysis, leading to the conclusion that meaning is influenced by approach motivation, holds promise for integrating past conceptual approaches to understanding meaning, and contemporary research on experimental manipulations that can increase it. Approach motivation can be influenced by both immediate circumstances and more enduring

elements in one's life. Immediate circumstances that hinder approach motivation (e.g., traffic jam) can cloud out thoughts about more global concerns regarding life's direction. These instances might make people feel more pessimistic about their overall life trajectory and focus their attention away from an optimistic future towards current troubles. If there are no immediate stumbling blocks, meaning would depend more on enduring life circumstances (e.g., career trajectory), allowing a more undistorted view of one's life. When on vacation, unhindered by immediate concerns, someone might feel either enthusiastic about how well their life is going or disturbed by their lack of fulfillment. Enduring elements like these will either catalyze optimism or bring about despair when compared to one's ultimate values.

In any given moment, both enduring circumstances and the immediate context will work together to either enhance or hinder levels of approach motivation, which will then go on to provide a feeling of meaning (or lack thereof).

### **Meaning and Self-Regulation**

The foregoing analysis of the motivational substrate of meaning in life is consistent with results of a large study in which 90% of respondents reported meaning above the midpoint on a scale (Heintzelman & King, 2014b). The authors suggest "the prevalence of meaningful lives might suggest additional sources of meaning that have previously been ignored". In addition to traditionally recognized "deep" sources of meaning in life, such as religion, worldviews, and close relationships, meaning in life may also be drawn from more mundane daily functions (e.g., habitual activities; everyday experience" (p.569). This is consistent with the proposal that approach motivation gives rise to perceptions of meaning. Indeed, many studies in the meaning literature find that mundane experimental manipulations can alter meaning (Heintzelman et al., 2013; King et al., 2006). If meaning is influenced by approach motivation, as proposed, then

even mundane immediate experiences that activate approach motivation should give rise to meaning. Indeed, empirical and theoretical work has linked immediate and enduring forms of coherence, purpose and significance to approach motivation.

## **Coherence**

Many recent theorists have proposed that coherence, a sense that predictability, routine, and comprehension underlies meaning (Battista & Almond, 1973; Heine et al., 2006; Heintzelman & King, 2013; Martela & Steger, 2016). This perspective is best exemplified by Heintzelman and King (2013)'s formulation: "...meaning is a fundamental aspect of awareness, a 'feeling of rightness' (James 1893), associated with the detection of lawfulness, regularity, and pattern" (p. 88). Here, meaning is thought to arise when things are congruent and make sense, a sort of homeostasis which sustains an inhibited view of the world. Meaning is hindered when this homeostasis encounters discrepancies and uncertainty, leading to inhibition and anxiety (Proulx & Heine, 2010; Proulx, Inzlicht, & Harmon-Jones, 2012).

This sense of inhibition is the crucial link between coherence and approach motivation. Inhibition arises when there is a lack of clear direction and uncertainty in one's environment (Harmon-Jones, Amodio, & Harmon-Jones, 2009; Hirsh, Mar, & Peterson, 2012), hindering one's ability to decide on a course of action, thus muting approach motivation (Corr, 2004; Inzlicht, McGregor, Hirsh, & Nash, 2009). Indeed, incoherence has been found to reduce approach motivated processes, turning one's focus away from eager goal pursuit, through inhibition, towards troubleshooting the source of incoherence (Jonas et al., 2014; McNaughton & Corr, 2004). This troubleshooting is necessary since having a clear, coherent idea about what to expect in the world and how best to proceed is crucial for a self-regulating organism, allowing it to predict the best course of action towards desired goals (Clark, 2013). Consistent with this,

incoherence is especially debilitating when it hinders one's ongoing goal pursuits. In one study, when participants encountered uncertainty regarding a specific goal domain (e.g., achievement), those who were previously primed with that goal experienced a greater need to reaffirm a sense of meaning by activating approach motivation (Nash, McGregor, & Prentice, 2011). Since inhibition and approach are often antithetical to each other (Corr, 2004), engaging in goal pursuit can also amplify coherence by blocking out inhibiting thoughts that threaten to derail focused completion of a goal, an adaptive phenomenon called goal-shielding (Shah, Friedman, & Kruglanski, 2002). Moreover, a vast literature has documented how people, when confronted with incoherence, try to gain relief by eagerly approaching a goal (for a review, see Jonas et al., 2014).

The proposed self-regulatory perspective contends that coherence contributes to meaning because it helps reduce inhibition, thus allowing for increased approach motivation. Both immediate and enduring sources of coherence are crucial. Incoherence while pursuing immediate goals will elicit inhibition, hindering approach motivation and immediate goal progress, thus diminishing meaning. When thinking about one's life over time, more enduring forms of incoherence like a disjointed worldview or an uncertain future would erode enthusiasm for what is to come, again leading to a lack of meaning.

Immediate, seemingly trivial manipulations of coherence have been shown to influence meaning. People are more prone to seek meaning when exposed to confusing art and literature as compared to the regular variety (Proulx, Heine, & Vohs, 2010), and tend to report lower meaning after seeing trees presented in an order incongruent (vs. congruent) with their seasonal content (Heintzelman et al., 2013). In other work, these same sorts of manipulations were found to influence approach motivation: participants reported less willingness to engage in goal-pursuit

when told about incoherent (e.g., leaves grow randomly on trees) vs. coherent “scientific” discoveries (e.g., leaves grow on trees due to coherent natural laws; Kay, Laurin, Fitzsimons, & Landau, 2014). Similarly, introducing inconsistencies about one’s self worth through being rejected in a computerized ball-tossing game or by a confederate in a lab led to decreased reported meaning (Stillman et al., 2009; Zadro, Williams, & Richardson, 2004), an effect that was moderated by a decreased sense of purpose (Stillman et al., 2009). My view is that all of these immediate manipulations help dampen approach motivated processes due to inhibition arising in reaction to incoherence.

More enduring sources of coherence such as life stories and worldviews provide a chronically accessible backstory to life that helps contextualize one’s pursuits across time. When derailed, as in the case of traumatic experiences, approach motivation can be hindered. Trauma is debilitating when fundamental worldview assumptions and beliefs are violated (such as a belief in a just world; e.g., Park, Edmondson, Fenster, & Blank, 2008) leading to a breakdown in one’s sense of coherence (Davis & Nolen-Hoeksema, 2001; Jonas et al., 2014; Park, 2010). This lack of coherence often leads to motivational disengagement (Park & Folkman, 1997). Indeed, research has consistently shown that those who experience trauma seek out meaning and are at risk of developing disorders such as PTSD, depression, and chronic anxiety (Breslau, Davis, Peterson, & Schultz, 2000; Shalev et al., 1998). To get rid of this inhibition and anxiety, individuals either attempt to find a way to reconcile the experience with a previously held worldview, or adopt another worldview, thus leading to successful re-engagement with life (Davis & Nolen-Hoeksema, 2001; Park & Folkman, 1997).



## **Purpose**

Although recent theorizing has focused on coherence, purpose has been emphasized, especially in early work, as an important contributor to meaning and well-being (e.g., Carver & Scheier, 1998; Elliot & Sheldon, 1998; Emmons, 2003; Klinger, 1977; Palys & Little, 1983; Van Hook & Higgins, 1988). Feeling like one has a purpose is intimately tied with a sense of efficacy: having a purpose without any means of attainment will result either in disengagement or a spiral into debilitating inhibition (Carver & Scheier, 1998; Gray & McNaughton, 2000). Indeed, purpose has been shown to correlate with general efficacy at .64 (DeWitz, Woolsey, & Walsh, 2009).

The proposed self-regulatory view sees both immediate goals and more enduring long-term life goals as helping to give rise to meaning by engaging approach motivation. Consistent with this view, positive affect, which arises when one is successfully progressing on both immediate and long-term goals (Carver & Scheier, 1998), leads to meaning. Manipulations of positive affect lead to increased meaning and trait positive affect tends to be correlated with meaning at .5 or above (Baumeister et al., 2013; King et al., 2006). The importance of a long-term, enduring purpose is also affirmed by recent work showing that eager optimism about future goal success is related to meaning (van Tilburg & Igou, 2018; Vazeou-Nieuwenhuis et al., 2017), a finding consistent with theories that have positioned purpose, efficacy, mastery, and growth as foundational criteria for meaning (Baumeister, 1991; Ryff, 1989). Accordingly, factors like having a clear trajectory and an eager predisposition to pursue goals will help sustain one's level of purpose, and therefore leads to approach motivation.

It is important to note that this past theoretical and empirical linkage between purpose and meaning is maintained even in the absence of significance. Indeed, even when controlling

the extent to which participant's personal goals reflected their ultimate values and ideals (which predicted meaning in life), mere efficacy also predicted meaning (McGregor & Little, 1998).

While being able to successfully pursue goals fuels approach motivation, these goals might not be aligned with significance values that further inspire meaning.

## **Significance**

Significance speaks to the degree to which life goals are in alignment with enduring values. Immediate significance can be had through accomplishments that align with these core values. Ultimate, enduring significance arises from seeing one's life as a whole, as approaching and exemplifying these values. This is contrasted with purpose, which contributes to meaning regardless of its alignment with one's core values. Indeed, meaning has been found to be associated with an alignment between goals and valued ideals (Emmons, 1999; McGregor & Little, 1998). In one study, meaning was also found to be uniquely related to spiritual values and ideals when controlling for purpose: "The fact that experiencing the transcendent uniquely predicts meaning is consistent with the idea that meaning refers to a sense of understanding and significance regarding life." (George & Park, 2013, p. 372).

Drawing on the Greek ideal of eudaemonia, scholars have found differences between hedonic orientations, focused on life pleasures, in contrast to eudaemonic orientations, which place a larger focus on values in life (Huta & Ryan, 2010; Ryff, 1989; Ryff & Singer, 2008). Eudaemonic values often focus on symbolic ideals that can work to transcend one's death: offering up one's life to a religion, a country, or a platonic value can make it so one's mundane strivings will have a lasting impact through their alignment with these more durable, immortal legacies (Greenberg, 2012). Moreover, the pursuit of these abstract values is associated with the same approach motivated processes as the pursuit of concrete goals (Amodio, Shah, Sigelman,

Brazy, & Harmon-Jones, 2004; Jonas et al., 2014; McGregor, Prentice, & Nash, 2012; Prentice & McGregor, 2014), and can provide additional motivational zeal as people feel eager to pursue their goals in lieu of their ultimate significance (McGregor et al., 2013).

For the proposed self-regulatory perspective on meaning, all three contributors to meaning play an important role: coherence helps approach motivation go on unhindered by the drag of inhibition and anxiety, purpose boosts approach motivation by providing a direction for one's pursuit, and significance inspires approach motivation by giving life an ultimate value. These contributors can enhance or hinder approach motivation both during immediate goals or through their more temporally enduring impacts on life trajectories.

### **Approach Motivation and Inhibition**

The self-regulatory perspective on meaning outlined in the present thesis is guided by theories that view the major axes of personality as being rooted in neuropsychological systems underlying approach motivation and inhibition.

#### **Approach Motivation**

Approach motivation is rooted in the Behavioural Approach System (BAS), which responds to and orients toward appetitive stimuli and controls all reward seeking behaviour (Corr & Krupić, 2017). Specifically, the BAS impels one to move towards a desired end-state: “The primary function of the system controlling approach behaviour is to move the animal up the temporo-spatial gradient, from a start-state (e.g., the idea of, or the physical distance to a source of food), towards the final biological reinforcer (e.g., consumption of food).” (Corr, 2013, p. 287). This system is powered by dopaminergic activity (the “wanting system”) that helps the organism to pursue a wide range of incentives ranging from food to abstract ideals (Berridge &

Robinson, 2016; Corr, DeYoung, & McNaughton, 2013; Jonas et al., 2014). This is in contrast to the “liking system,” which acts to consume rewards once obtained.

Approach motivation is thought to bring about certain affective and emotional states (McNaughton & Corr, 2009), specifically “states of desire, eagerness, excitement, and hope.” (Corr et al., 2013, p. 163). Consistent with this idea, approach motivation has been linked with feelings of power, efficacy, hope, and enthusiasm (Alloy et al., 2012; Drake & Myers, 2006; Harmon-Jones, Harmon-Jones, & Price, 2013; Keltner, Gruenfeld, & Anderson, 2003; McGregor, Nash, Mann, & Phills, 2010). Activation of approach motivation blocks irrelevant information and conflicting cognitions, rendering an agent feeling focused and uninhibited by conflict and incoherence (Harmon-Jones et al., 2009; Shah et al., 2002).

Approach motivation is associated with a variety of related personality traits. Within the Big-5, both Extraversion and Openness to experience are seen as appetitive traits and are associated with approach motivation (Corr et al., 2013; DeYoung, 2015). Approach motivation also relates to trait promotion focus which is characterized by the approach of desired outcomes and the pursuit of inspiring high standards (Lockwood, Jordan, & Kunda, 2002). Moreover, approach motivation has been linked to power (uninhibited, eager behaviour with accompanying positive affect; Keltner et al., 2003), efficacy (characterized by feelings of ability and mastery of goal-directed behaviour; Wolters, Shirley, & Pintrich, 1996), and hope (aspirational anticipation of goal attainment; McGregor et al., 2010; Snyder et al., 1991), all of which share a general tendency to be forward-focused with eager emotional affect.

## **Inhibition**

The Behavioural Inhibition System (BIS) activates anxiety to allow an organism to respond to goal conflicts and incoherence, organizing its resources towards troubleshooting uncertainties regarding how to move forward, rather than eager plan execution (McNaughton & Corr, 2004). Anxiety is the affective response that emerges from the confrontation with incoherence and uncertainty: “The action of the BIS is evident when there is a conflict...[it] produces passive avoidance and risk assessment and contributes to processes that produce the state of anxiety” (Corr et al., 2013, p. 162). Furthermore, this inhibition system is preferentially influenced by anti-anxiety drugs, such as barbiturates and selective serotonin reuptake inhibitors, which act to dampen BIS activity (Gray & McNaughton, 2000).

Importantly, in its sensitivity for any discrepancies that threaten goal pursuit, this system is activated by anything from subtle uncanniness (e.g., surrealist literature; Proulx et al., 2010) to gross discrepancies (e.g., trauma; Pennebaker, 1985) and acts to stop ongoing approach motivation: “The main task of the BIS is to detect and resolve goal conflicts. In doing this, it inhibits any prepotent approach behaviour that the BAS...[was] about to carry out.” (Corr & Krupić, 2017, p. 59). As a result, the approach and inhibition systems tend to be reciprocally active, with one’s activity suppressing the other (Corr, 2004; Inzlicht, McGregor, Hirsh, & Nash, 2009). This is consistent with the aforementioned link between incoherence and inhibition: a lack of coherence causes uncertainty about how best to proceed, thus downregulating the approach system and, as proposed, hindering one’s sense of meaning.

However, if the BIS is not able to resolve incoherence and restore approach motivation enduring BIS-activation characterized by anxiety and sensitivity to uncertainty can ensue: “in hyper-BIS individuals, its activation leads to a marked and chronic passive avoidance and

cognitive rumination” (Corr & Krupić, 2017, p. 59). Such individuals become plagued by their awareness of discrepancies, a condition linked to neuroticism (Corr et al., 2013). Trait rumination, uncertainty aversion, felt-uncertainty, and perceived stress also directly relate to central BIS-related activity of detecting incoherence and trying to quickly resolve discrepancies (S. Cohen, Kamarck, & Mermelstein, 1983; Greco & Roger, 2001; McGregor, Zanna, Holmes, & Spencer, 2001; Trapnell & Campbell, 1999). Trait prevention focus, a focus on avoiding undesired end-states, is also theoretically related to inhibition, as it is characterized by hypervigilance for possible loss and anxiety after chronic failure (Higgins, 1998; Klenk, Strauman, & Higgins, 2011). Attachment anxiety involves chronic relationship-related rumination and behavioural inhibition (Manassis, Bradley, Goldberg, Hood, & Price Swinson, 1995) and the need for structure is characterized by structure seeking in order to avoid incoherence (Neuberg & Newsom, 1993). Both of these traits relate to BIS tendencies to seek out and get rid of discrepancies (Corr, 2008).

### **Present Research**

The present thesis has proposed that immediate and enduring forms of all three contributors to meaning (coherence, purpose, and significance) influence approach motivation. Approach motivation then gives rise to meaning by making people feel like they’re successfully approaching valued and worthy goals in their life, free from inhibition. Previous work has primarily emphasized coherence and lack of inhibition as being the key contributor to meaning (Heine et al., 2006; Heintzelman & King, 2014a; Heintzelman et al., 2013; Proulx & Inzlicht, 2012; Randles, Proulx, & Heine, 2011). To explore whether approach motivation plays a unique role, three studies will test to see if approach motivation gives rise to meaning when accounting for coherence and inhibition.

All three studies include both trait and state measures linked to approach and inhibition. This is to explore the degree to which enduring and immediate sources of approach and inhibition influence meaning. Studies 1a and 1b (all conducted with the same group of participants at different times over the course of four months) assess the extent to which approach motivation uniquely predicts meaning. Studies 1a, 2a, and 3a investigate how trait and state measures of approach and inhibition relate to meaning. Study 1b explores how genetic variants related to approach motivation influence meaning.

To explore the influence of immediate sources of meaning I employed several experimental designs. Study 1c experimentally manipulated approach motivation, to establish a causal link. Studies 2b and 3b compared the influence of experimentally manipulated significant values and approach motivation conditions to inhibition (Studies 2b and 3b) and baseline (Study 3b) conditions on meaning using within-subject designs. Finally, mediational analyses tested to see whether approach motivation mediated these effects.

## CHAPTER 2: EMPIRICAL STUDIES INVESTIGATING APPROACH MOTIVATION AND MEANING

### **Study 1a**

All data for Study 1 were collected over four sessions as part of a larger study. The first three sessions involved participants filling out personality measures and undergoing various manipulations. Genetic data was collected in the fourth session. A detailed account of full materials from the study are included in Appendix A.

Study 1a used correlational evidence to test whether approach motivation gives rise to meaning. Inhibition and approach related state and trait measures were collected to see if approach motivation's contribution to meaning is unique when accounting for the effects of coherence. Positive affect was also measured to see if the predicted relationship between approach motivation and meaning was robust when controlling for this variable. Positive affect has been associated with purpose, but lacks a strong consideration of overall life values (i.e., significance; Baumeister et al., 2013; Ryff & Singer, 2008), a key contributor to meaning.

### **Methods**

**Participants and design.** Three hundred and thirty-three undergraduates (230 female, 1 other, 6 gender unknown;  $M_{\text{age}} = 21.6$ ) participated in two online and two in-lab sessions as a component of a larger investigation. These sessions were, on average, conducted two days apart. Previously published results have used data from this study that does not pertain to the current focus (Huynh, Oakes, Shay, & McGregor, 2017). A detailed account of full materials from the study are included in Appendix A.



**Positive affect.** Participants completed a Positive Affect scale (Watson, Clark, & Tellegen, 1988, 10 items; e.g., "[I feel] happy").

**Approach motivation-related traits and states.** Participants rated the following scales across three sessions: Approach Motivation (Lockwood, Jordan & Kunda, 2002, 8 items; e.g., "I frequently imagine how I will achieve my hopes and aspirations"; "I often think about the person I would ideally like to be in the future.", "I typically focus on the success I hope to achieve in the future."), Generalized Self-Efficacy scale (Schwarzer & Jerusalem, 1995, 10 items; e.g., "It is easy for me to stick to my aims and accomplish my goals."), Generalized Sense of Power scale (Anderson & Galinsky, 2006, 8 items; e.g., "I think I have a great deal of power."), Openness to Experience 1 (Goldberg, 1992, 10 items; e.g., "I am quick to understand things."), Extraversion (Goldberg, 1992, 10 items; e.g., "I am the life of the party."), Hope scale (Snyder et al., 1991; 8 items, e.g., "I can think of many ways to get the things in life that are most important to me."), and state measures of the BAS scale (Carver & White, 1994, 13 items; e.g., "[I feel like] I would go all-out to get something I wanted") which were used after a separate manipulation included in the larger part of the study<sup>1</sup>. These variables were all averaged to create an approach motivation composite ( $\alpha = .80$ ). This composite was used as a predictor in a simultaneous regression analysis with the inhibition composite.

**Inhibition-related traits and states.** Participants rated the following scales across three sessions: Neuroticism (Colin G. DeYoung, Quilty, & Peterson, 2007, 10 items; e.g., "I get stressed out easily."), Uncertainty-aversion (Greco & Roger, 2001, 15 items; e.g., "When

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<sup>1</sup> Full description of all material included in Appendix A. State measures of BAS were included as part of another manipulation asking people to think of something meaningful versus meaningless. No significant effects were found. This was interpreted, in conjunction with results from Study 1c, to be due to the effects of approach motivation not persisting temporally after the manipulation. This assumption is tested in the within-subjects work with measures of approach motivation more closely tied to the manipulation.

uncertain about what to do next, I tend to feel lost."), Rumination (Trapnell & Campbell, 1999, 12 items; e.g., "I often reflect on episodes in my life that I should no longer concern myself with."), Attachment anxiety (Brennan, Clark, & Shaver, 1998, 18 items; e.g., "I worry a lot about my relationships"), Prevention focus (Lockwood et al., 2002, 9 items; e.g., "I am more oriented toward preventing losses than I am toward achieving gains."), Need for structure (Neuberg & Newsom, 1993, 12 items; e.g., "I hate to be with people who are unpredictable."). These were all averaged to create an anxiety composite ( $\alpha = .87$ ).

**Meaning.** Participants completed two assessments of meaning-presence: a state and trait version of the meaning in life scale (Steger et al., 2006, 5 items; "I understand my life's meaning", "My life has a clear sense of purpose.", "I have a good sense of what makes my life meaningful.", "I have discovered a satisfying life purpose.", reverse scored: "My life has no clear purpose."). State meaning was measured after the between-subjects manipulation in Study 1c. Trait and state meaning were combined as the main dependent variable for a more reliable measure of meaning (correlation of .82; See Table 1 for all inter-correlations for traits and states in Studies 1a and 1b).

Table 1  
Correlations for Trait and State Approach, Inhibition, and Meaning Measures for Study 1.

Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. State BAS	-													
2. Approach Motivation	.475***	-												
3. Self-Efficacy	.292**	.242**	-											
4. Power	.227***	.311***	.529***	-										
5. Hope	.305**	.368***	.701***	.549***	-									
6. Extraversion	.330***	.231**	.267***	.367***	.283***	-								
7. Openness to Experience	.316***	.354***	.420***	.376***	.371***	.223***	-							
8. Neuroticism	.098	.022	-.304***	-.274***	-.293***	-.097	-.015	-						
9. Uncertainty Aversion	.130*	.056	-.310***	-.245***	-.238***	-.171**	-.189**	.579***	-					
10. Rumination	.196**	.117*	-.205***	-.254***	-.242***	-.148*	.009	.549***	.575***	-				
11. Attachment Anxiety	.258***	.022	-.125*	-.214***	-.159**	-.101	-.110	.585***	.650***	.506***	-			
12. Prevention Focus	.241***	.222***	-.140*	-.086	-.175**	-.116*	-.022	.469***	.490***	.452***	.511***	-		
13. Need for Structure	-.020	-.140*	-.377***	-.304***	-.383***	-.152**	-.181**	.591***	.542***	.558***	.484***	.404***	-	
14. Meaning Presence	.084	.292***	.268***	.257***	.425***	.196**	.110	-.225***	-.226***	-.252***	-.131*	-.188**	-.296***	-
15. State Meaning Presence	.023	.295***	.317***	.324***	.463***	.164**	.120*	-.263***	-.264***	-.293***	-.198**	-.195**	-.344***	.823***

Note. \*  $p < .05$  \*\*  $p < .01$ . \*\*\*  $p < .001$

## Results

**Correlational analyses.** All approach-related traits had significant inter-correlations between .22 and .55 (all  $ps < .01$ ) and all inhibition-related traits had significant inter-correlations between .40 to .59 (all  $ps < .001$ ). The approach motivation composite was computed using standardized averages of all the approach-related scales ( $\alpha = .80$ ). Similar procedure was used for the inhibition composite ( $\alpha = .87$ ). Consistent Corr's (2004) joint subsystems view of inhibition and approach processes as being reciprocally active, the approach and inhibition composites were negatively correlated,  $r(330) = -.26, p < .001$ .

The zero order correlation between approach and meaning composite was significant,  $r(292) = .38, p < .001$ , as well as the correlation between the inhibition and meaning composite,  $r(292) = -.36, p < .001$ . A partial correlation was conducted to control for the effects of positive affect. Both approach,  $r(151) = .24, p < .003$ , and inhibition,  $r(151) = -.28, p < .001$ , maintained their significant relationship with meaning.

A two-step hierarchical regression to tested the prediction that approach motivation's relationship with meaning is robust even after accounting for inhibition. In step one, meaning was regressed onto approach motivation, yielding a significant model,  $F(1, 292) = 48.50, p < .001, R^2 = .14$ , and revealing a significant relationship between approach motivation and meaning<sup>1</sup>,  $\beta = .38, p < .001$ . Inhibition was added in the second step, and the model was significantly improved,  $F(1, 291) = 32.95, p < .001, \Delta R^2 = .08$ .<sup>2</sup> As predicted, when accounting

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<sup>2</sup> Only 294 out of the total 333 participants filled out scales for meaning, therefore rendering them ineligible for the analysis.

for inhibition's contribution,  $\beta = -.29, p < .001$ , approach motivation maintained its significant relationship,  $\beta = .31, p < .001$ .

## **Discussion**

Results from Study 1a provides initial evidence to support the hypothesis that approach motivation gives rise to meaning. Approach motivation seemed to be robustly related to meaning, displaying a strong positive correlation with meaning and explaining more unique variance than inhibition in a hierarchical regression. It also maintained its relationship with meaning when controlling for positive affect.

### **Study 1b**

Study 1b looked at genetic evidence to further test the hypothesis that approach motivation gives rise to meaning. The dopaminergic system is heavily involved in motivational processes for both human and animal models (DeYoung, 2013; Rubinstein et al., 1997). Variants of the dopamine D4 receptor (DRD4) gene have been associated with increased approach motivational characteristics such as novelty seeking and extraversion (Lahti et al., 2005; Strobel, Wehr, Michel, & Brocke, 1999; Swift, Larsen, Hawi, & Gill, 2000). Specifically, 7 and 2 repeat alleles are implicated in boosted dopaminergic levels by downregulating inhibitory dopamine receptors (Oak, Oldenhof, & Van Tol, 2000; Rubinstein et al., 2001). To explore the potential influence of approach motivation on meaning, genetic data regarding DRD4 variation was gathered — it was reasoned that variants in the gene of this sort would increase approach motivation and, if the hypothesized link between approach motivation and meaning is correct, also increase meaning.

## Methods

**Participants and design.** The same sample and design was used as reported in Study 1a. In the fourth session, participants came into the lab and gave buccal swab samples for genetic analyses in order to determine their DRD4 variants. A detailed account of full materials from the study are included in Appendix A.

**Approach motivation, meaning, and positive affect.** The same measures used in Study 1a were used here as well.

**DNA collection, extraction, and genotyping.** Buccal samples for DNA analysis were collected using the Whatman OmniSwab pn:WB100035 (GE Healthcare, PA, USA) according to manufacturer recommendations. Following sample collection, buccal swabs were added to 750uL of lysis buffer (50mM Tris pH 8.0, 50mM EDTA, 25mM Sucrose, 100mM NaCl, 1% SDS) and incubated with 25uL of 10mg/mL Proteinase K (Invitrogen, CA, USA) at 55°C overnight with rotation. 650uL sample lysate was input to an automated DNA extraction process performed on the Qiagen Biosprint96 instrument. DNA was extracted with Aline Biosciences Buccal Swab gDNA Kit and eluted into 225uL of the manufacturer's elution buffer. Samples were quantified by fluorometric assay (QuantiFluor dsDNA System, Promega, Madison WI, USA), and concentrations were measured on a Synergy HT (BioTEK, VT, USA). Samples were normalized to 5ng/uL. DRD4 locus was amplified using the labeled forward primer 5'- [6-FAM]TGCTCTACTGGGCCACGTCC-3' and the unlabeled reverse primer 5'- TGCGGGTCTGCGGTGGAGTCT-3'. Polymerase chain reaction (PCR) was performed in a total volume of 10uL containing 10ng of DNA, 0.2uL of each primer (20uM stock), 0.2uL Terra PCR Direct Polymerase Mix, 5.0uL 2X Buffer (Takara, CA, USA) and 2.4uL molecular grade water. PCR cycling conditions consisted of an initial 3 min denaturation at 98°C, followed by 35

cycles of 98°C for 15 s, 62.5°C for 20 s, 72°C for 30 s and finally 72°C for 5 min. PCR products were electrophoresed on an ABI 3730 DNA analyzer (Applied Biosystems) with a LIZ1200 size standard (Applied Biosystems). Data collection and analysis used GeneMarker v1.85 Software (Soft Genetics, PA USA)

## Results

**DRD4 genotype distribution.** Due to participation attrition across sessions, genetic data for 170 participants was obtained. Of the 170 total participants, 66 were carriers, having at least one 7-repeat allele or 2-repeat allele, and 104 were non-carriers, having neither a 7- or 2-repeat allele (93 had two 4-repeat alleles, and the remainder had 3-, 5-, 6-, or 8-repeat alleles).

Consistent with past work including diverse participant samples (Kitayama et al., 2014; Reist et al., 2007; Sasaki et al., 2013), participants with at least one of the two repeat alleles (7- or 2-repeat) were coded as “carriers” ( $n = 66$ ) and those without either 7- or 2-repeat alleles as “non-carriers” ( $n = 104$ ). Some participants did not have scores for meaning leaving 99 non-carriers and 57 carriers in the analysis.

**Genetics analysis.** DRD4 significantly correlated with approach,  $r(168) = .20, p = .008$ , but not inhibition,  $r(168) = -.07, p = .340$ . Furthermore, when controlling for positive affect, the partial correlation between DRD4 and approach motivation was maintained,  $r(151) = .26, p = .001$ .

A regression analysis was conducted to see the potential affects of DRD4 polymorphisms on meaning by regressing the meaning composite on the DRD4 polymorphism variable. The analysis found that carriers of the DRD4 2 and 7 repeat alleles marginally predicted meaning in life,  $t(154) = 1.93, SE = .13, p = .056. d = 0.32$ , an effect that was maintained when controlling for positive affect ( $t(153) = 1.99, SE = .93, p = .053. d = 0.31$ ). To see if approach motivation

mediated this relationship, a mediation analysis conducted using ordinary least squares path analysis with the PROCESS macro for SPSS (Hayes, 2013) found that the DRD4 variation indirectly influenced meaning through its effects on the approach motivation composite. DRD4 polymorphism differences influenced reported approach motivation ( $a = 0.34$ ) and participants with higher levels of approach motivation in turn reported greater meaning ( $b = 0.46$ ). A bias-corrected bootstrap confidence interval for the indirect effect ( $ab = .16$ ) based on 5,000 bootstrap samples didn't include zero (0.06 to 0.33). There was no evidence that DRD4 influenced meaning independent of its effects on approach motivation ( $c' = 0.16, p = .330$ ; See Figure 1)

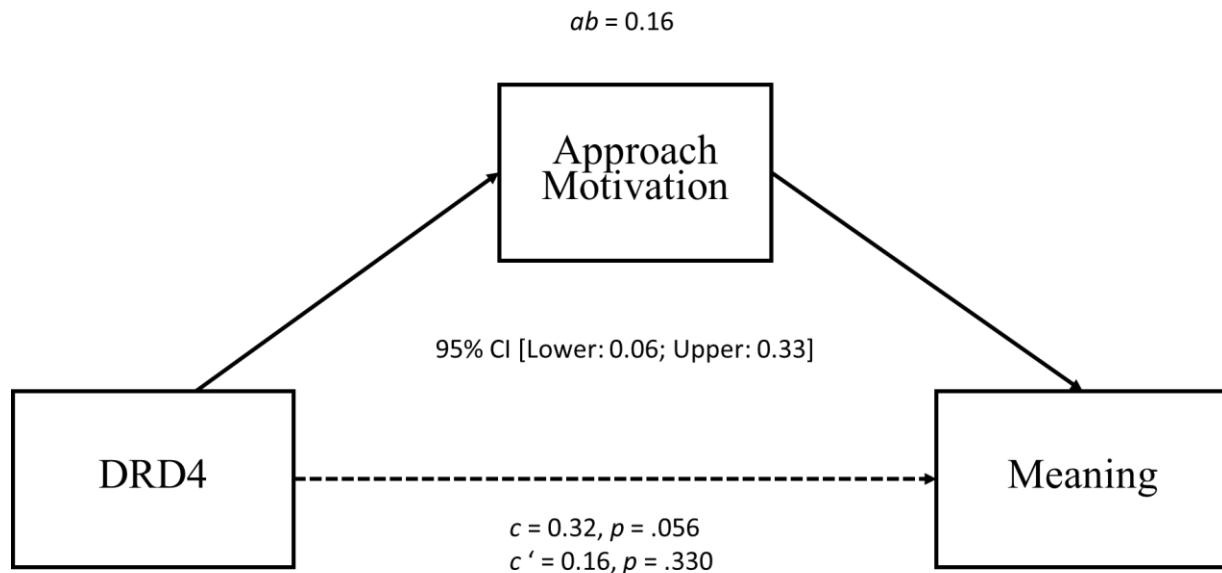


Figure 1. Mediation analysis of DRD4 7 and 2 repeat carriers vs. non-carriers and their direct and indirect effects on meaning through the trait approach motivation composite. Based on 5,000 bootstrap samples.



## **Discussion**

Results from Study 1b produced findings showing a marginal relationship between DRD4 variants related to dopaminergic activity and meaning. This relationship was significantly mediated by approach motivation. Inhibition was not related to DRD4 variation. This suggests that those who have a predisposition to engage in goal-directed behaviour maintain a high level of approach motivation and therefore meaning. However, given the marginal effect, a future replication is needed before being confident in the findings.

### **Study 1c**

Study 1c used a between-subjects design to see whether approach motivation led to feelings of meaning. Participants were explicitly priming approach motivation, avoidance motivation, and a control free thought control condition to see if approach motivation would reliably result in increased reports of meaning. Avoidance motivation is related to avoiding an undesired outcome and while a powerful motivating force, has been linked with inhibition and maladaptive behaviour (Elliot & Thrash, 2002).

I expected to see an increase in meaning after the approach manipulation and a decrease in meaning after the avoidance manipulation, relative to the free thought control condition.

## **Methods**

**Participants and design.** The same sample and design was used as reported in Study 1a. In the fourth session, participants came into the lab and gave buccal swab samples for genetic analyses in order to determine their DRD4 variants. A detailed account of full materials from the study are included in Appendix A.

**Between subjects prime.** Participants were randomly assigned to one of three conditions. In the approach motivation condition they were asked to describe something they eagerly wanted to approach (“For the next 2 minutes, please describe something you powerfully desire, and how you feel when you imagine yourself approaching it.”). In the avoidance motivation condition they were asked to describe something they would really like to avoid (“For the next 2 minutes, please describe something you powerfully wish to avoid, and how you feel when you imagine yourself avoiding it.”). For the free thought control condition they were asked to passively record whatever thoughts come to mind (“LET YOUR MIND WANDER. As you do this, record any thoughts that pass through your mind, in the space below. Feel free to be as brief or descriptive as you like.”). After this, participants were asked to report their state meaning (“Please rate your agreement with each of the following statements RIGHT NOW, IN THE PRESENT MOMENT.”. These instructions helped capture state measures of meaning using the original trait scale items; Steger et al., 2006, 5 items; “I understand my life’s meaning”, “My life has a clear sense of purpose.”, “I have a good sense of what makes my life meaningful.”, “I have discovered a satisfying life purpose.”, “My life has no clear purpose.”, reverse scored ). This was the main dependent variable for the analysis.

## **Results**

**Between subjects analysis.** The ANOVA revealed a marginal main effect of condition on meaning,  $F(2, 330) = 2.62$ ,  $MSE = .749$ ,  $p = .074$ ,  $\eta^2_p = .020$ . LSD post-hoc tests revealed significant differences in state meaning between the approach motivation condition ( $M = 3.20$ ,  $SE = 0.08$ ) and the free thought control condition ( $M = 2.94$ ,  $SE = 0.08$ ),  $p = .030$ . The avoidance motivation condition ( $M = 3.15$ ,  $SE = 0.08$ ) only marginally differed from the free thought

control condition, however,  $p = .094$ . The avoidance and approach motivation conditions did not differ significantly,  $p = .633$ .

## **Discussion**

Study 1c provides some support for approach motivation's role in giving rise to meaning. While only finding a marginal main effect, post-hoc comparisons found that approach motivation significantly increased meaning relative to the free thought control condition, while the avoidance condition marginally differed from the control condition. However, approach motivation and avoidance motivation did not significantly differ from one another.

Contrary to my predictions, the avoidance motivation condition did not seem to decrease the amount of meaning relative to the control condition, perhaps belying residual approach motivation that is inherent in any forward looking motivational process (Corr & Krupić, 2017). Another potential explanation for this result is that past work finds participants tend to react to threatening circumstances by defensively upregulating their approach motivation (Jonas et al., 2014; McGregor et al., 2010). Therefore, participants might have increased their approach motivation after the avoidance manipulation caused them to think about something they desperately wanted to avoid, leading to increased self-reported state meaning. To counteract this, the next study will ask participants to retroactively attribute their state meaning at the time of the manipulation using a within-subject analysis.

## **Study 2a**

All data for Study 2 was collected over eight sessions as part of a larger study. The first four sessions were conducted in the fall term, and the latter four in the winter term. Each session

involved participants filling out personality measures and undergoing one within-subject manipulation (discussed in Study 2b). Trait measures were measured once throughout the design, and state measures were measured after every within-subject manipulation (four measures for each term). The winter term largely mimicked the fall term design, but varied the order in which participants underwent each manipulation. A detailed account of full materials from the study are included in Appendix A. Study 2a aimed to replicate Study 1a results by looking to see if a widened set of composite trait and state scores for approach motivation and inhibition would replicate the results.

## Methods

**Participants and design.** Two samples of undergraduate students were collected in the fall and winter semesters of the same academic year at the University of Waterloo using highly equivalent designs. Following the first round of data collection expected results were pre-registered for the replication regression analyses (<https://osf.io/krz3b/>).<sup>1</sup> Results from the pre-registered half of the data were all in the same predicted direction as the first half of the data. Therefore, to maximize confidence in the results, the two samples were combined to produce a total sample of one hundred and forty-seven (35 male;  $M_{\text{age}} = 21.28$ ) in order to achieve the best possible statistical power. The two samples did not differ in trait composite measures of approach, inhibition, and meaning,  $t_s < 1.22$ ,  $p_s > 0.23$ . Results from the initial and pre-registered sub samples are presented in Appendix B.

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<sup>1</sup> Separated analyses for each sub sample is available in the Appendix B, along with a reporting of all pre-registered analyses and predictions. Trait felt meaning was used as a baseline condition in the within-subjects design, but then removed from the main reported analyses here despite confirming predictions. This was due to it being deemed not appropriate to serve as a baseline since it had a different wording relative to the retrospective meaning measures. Accordingly, Study 3 used a manipulated control condition using a similar within-subjects design.

Participants went through an online survey that spanned four sessions which were required to be at least four hours apart. They were assessed on various trait and state measures related to inhibition, approach motivation, and meaning in life. The trait versions had the following general stem: “Please rate the extent to which each of the following statements generally applies to you” while the state focused on the present moment: “Please rate your agreement with each statement below, based on how you feel at this very moment”. All state measures listed below were also used as dependant variables for Study 2b. A detailed account of full materials from the study are included in Appendix A.

### **Measures used to replicate Study 1a.**

**Inhibition measures.** Participants rated the following scales: the Perceived Stress Scale (Cohen, Kamarck & Mermelstein, 1983, 14 items; e.g., “In the last month, I have often felt nervous and/or stressed.”), Rumination (Trapnell & Campbell, 1999, 12 items; e.g., “I often find myself re-evaluating something I've done”), BIS-sensitivity (Carver & White, 1994, 7 items; e.g., “If I think something unpleasant is going to happen, I usually get pretty worked up”), Neuroticism (DeYoung, Quilty & Peterson, 2007, 20 items; e.g., “Get upset easily.”), Uncertainty Aversion (Greco & Roger, 2001, 15 items; e.g., “I get worried when a situation is uncertain”), and Attachment Anxiety (Fraley, Waller & Brennan, 2000, 18 items; e.g., “I worry about being abandoned”).

They also rated their states and traits on state and trait versions of the Felt-Uncertainty scale (McGregor et al., 2001; 13 items, e.g., “I feel uneasy”), and state and trait versions of the Subjective Salience of Worries scale (McGregor & Marigold, 2003, 5 items; e.g., “Like my worries feel urgent [right now]”). The state versions of the Felt Uncertainty and Subjective

Salience scales were assessed four times over the course of four weeks, and scores were averaged.

Participants also rated the extent to which their goals were inhibition-prone. First they were asked to generate a list of important (current concerns and goals) in their lives, “In the next two minutes, please jot down as many of the personal projects that characterize your life as you can think of. Personal projects are the current concerns and goals, large and small, that you find yourself thinking about and wanting to do something about. We all have many personal projects in our lives, e.g., “get an A,” “improve my relationship,” “save money,” “work out more,” “be nicer to my room-mate,” “volunteer,” “walk the dog daily,” etc.” They were asked to briefly describe their four most important personal projects, “From your list of projects, please select the four that feel most important to you at the moment, and write them in the boxes below”. They then rated each goal on the extent to which it was associated with six dimensions related to conflict and inhibition: Avoidance (“This personal project focuses on avoiding something negative”), Prevention (“This personal project focuses on preventing bad things from happening”), Should Focus (“This personal project feels like something that I SHOULD be doing, regardless of what I would ideally like to be doing”), Demands from Others (“I have this goal because someone else of the situation demands it”), Uncertainty (“I have a lot of uncertainty about this goal”), and Conflict (“This goal conflicts with my other goals”). The four ratings across the six personal project dimensions (i.e., 24 scores) were averaged for an index of the extent to which participant’s goals were inhibition-prone.

In contrast to Study 1a’s approach of averaging all measures, the pre-registered analysis for this study included a factor score for all the inhibition measures (as well as the approach and meaning measures) to get a more reliable measure of the underlying shared variance. For an

overall index of inhibition, the nine inhibition-related trait scales, along with the two inhibition-related state scales, and the goal-inhibition composite score were entered into a principal components analysis and saved the first factor score with the expectation that it would reflect a single dominant inhibition factor with high loadings from all 11 of the contributing assessments.

**Approach measures.** Participants rated their approach traits on the following scales: Regulatory Mode Locomotion (Higgins, Kruglanski, & Pierro, 2003, 12 items; e.g., “When I decide to do something, I can’t wait to get started”), Approach Motivation (Lockwood, Jordan & Kunda, 2002, 8 items; e.g., “I frequently imagine how I will achieve my hopes and aspirations”)<sup>1</sup>, state and trait version of the BAS-Drive scale (Carver & White, 1994, 4 items; e.g., “[I feel like] I would go all-out to get something I wanted”), and state and trait versions of the BAS-Reward scale (Carver & White, 1994, 2 items; e.g., “[I feel like] I would get excited right away if I saw an opportunity for something I liked”). As with the inhibition-related states, the state versions of the BAS-Drive and BAS-Reward scales were assessed four times over the course of four weeks, and scores were averaged.

Participants also rated four goals (same goals elicited with the “personal projects” measure described in the inhibition measures section) on the extent to which each was associated with six characteristics related to approach motivation: Approach (“This personal project focuses on approaching something positive”), Promotion (“This personal project focuses on promotion of good things that I have high hopes for”), Determination (“I am firmly determined to complete this personal project, even if it requires sacrifices”), Wanting-Focus (“This personal project feels like something I truly and ideally want to be doing, regardless of what I feel I should be doing”),

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<sup>1</sup> As per Summerville and Roese (2008), the General Regulatory Focus Measure has been shown to overlap more strongly with approach motivation than with promotion-focus.

Choice (“I choose this personal project i.e., it was not dictated to me by other people or circumstances”), and Freedom (“I feel free to be who I am when pursuing this goal”). The four ratings across the six personal project dimensions (i.e., 24 scores) were averaged for an index of the extent to which participants’ projects were approach-oriented. For an overall index of approach traits and states the four approach-related trait scales, along with the two approach-related state scales, and the approach-goal composite score were entered into a principal components analysis and saved the first factor score with the expectation that it would reflect a single dominant approach factor with high loadings from all seven of the contributing assessments.

**Meaning measures.** Participants rated the following meaning measures: Meaning in Life scale (Steger et al., 2006, 5 items; e.g., “I understand my life’s meaning”); a trait version of a newly created Felt Meaning scale (4 items; “My life feels meaningful.”, “My life feels like it has clear purpose.”, “My life feels like it makes sense.”, “My life feels significant and like it matters.”), and a state version (4 items; e.g., “Right now, at this very moment, my life feels like it makes sense.”). As with the inhibition and approach state scales, the state version of the Felt-Meaning scale was assessed four times over the course of four weeks, and scores were averaged. State retrospective ratings of meaning after each within-subject manipulation (discussed in Study 2b methods) was also included and averaged across the four weeks (3 items; e.g., “What I just described is of great importance to my life.”). The trait Felt Meaning and the Meaning in Life scales were compared to see if there were any differences between the feelings people had about meaning and more “objective” reports on whether they understand their life’s meaning.

Participants also rated their four goals (same goals elicited with the “personal projects” measure described in the last two sections) on the extent to which each was associated with three



dimensions related to meaning: Core Value Congruence (“This personal project reflects the most important values that guide my life”), Self-Identity Relevance (“This personal project reflects the kind of person I really am, at my core”), and Devotion (“I feel certain that this is a personal project that I want to devote myself to”). These and related dimensions have predicted meaning in life ratings in past research (McGregor & Little, 1998). The three ratings across the six personal project dimensions (i.e., 12 scores) were averaged for an index of the extent to which participants’ projects were meaning oriented.

To create an overall index of meaning to be used as the main dependent variable below, the trait Meaning in Life scale along with the trait and state Felt Meaning scales, and the composite score derived from the three meaning goal dimensions were entered into a principal components analysis and saved the first factor score with the expectation that it would reflect a single dominant meaning in life factor with high loadings from all three of the contributing assessments. (See Table 2 for all inter-correlations between approach, inhibition, and meaning measures.)

Table 2  
Correlations for Trait and State Approach, Inhibition, and Meaning Measures for Study 2

Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. BAS	-																	
2. Approach Motivation	.406***	-																
3. Locomotion	.491***	.564***	-															
4. Approach States	.708***	.449***	.578***	-														
5. Approach Goals	.272**	.487***	.400***	.416***	-													
6. Neuroticism	-.079	-.158	-.298***	-.234**	-.243**	-												
7. Uncertainty Aversion	-.165*	-.185*	-.301***	-.244**	-.193*	.700***	-											
8. Rumination	.027	-.117	-.124	-.066	-.199*	.610***	.642***	-										
9. Attachment Anxiety	.027	-.062	-.116	-.072	-.175*	.597***	.588***	.574***	-									
10. BIS	-.037	.027	-.132	-.047	-.119	.615***	.664***	.612***	.476***	-								
11. Perceived Stress	-.033	-.155	-.317***	-.205*	-.256**	.772***	.679***	.603***	.568***	.609***	-							
12. Subjective Salience	.020	-.054	-.189*	-.128	-.137	.609***	.551***	.472***	.511***	.453***	.629***	-						
13. Felt Uncertainty	-.073	-.132	-.186*	-.248**	-.268**	.593***	.503***	.520***	.530***	.349***	.579***	.697***	-					
14. Inhibition States	-.043	-.114	-.119	-.166*	-.253**	.660***	.507***	.527***	.603***	.375***	.628***	.685***	.747***	-				
15. Inhibition Goals	.006	-.036	-.195*	-.156	-.177*	.321***	.278**	.171*	.414***	.140	.367***	.411***	.434***	.525***	-			
16. Meaning Presence	.109	.327***	.359***	.254**	.349***	-.431***	-.341***	-.400***	-.414***	-.207*	-.439***	-.472***	-.538***	-.467***	-.282**	-		
17. Felt Meaning	.287**	.415***	.509***	.452***	.461***	-.504***	-.369***	-.332***	-.328***	-.153	-.485***	-.435***	-.508***	-.505***	-.323***	.715***	-	
18. Meaning States	.252**	.412***	.455***	.462***	.458***	-.520***	-.384***	-.311***	-.357***	-.188*	-.500***	-.453***	-.518***	-.567***	-.343***	.725***	.867***	-
19. Meaning Goals	.328***	.464***	.503***	.334***	.729***	-.157	-.137	-.203*	-.029	-.114	-.187*	-.064	-.191*	-.175*	-.118	.265***	.386***	.363***

Note. \*  $p < .05$  \*\*  $p < .01$ . \*\*\*  $p < .001$ .

## Results

**Study 1a replication.** The three principal components analyses revealed the expected single-factor solutions for inhibition, approach, and meaning with all expected loadings above 50, and with the first factor in each case accounting for 60%, 59%, and 68% of variance, respectively. None of the other factor loadings accounted for more than 20% of the variance. Further, on the Meaning factor, the loadings of cognitive assessments of meaning in life and trait and state Felt Meaning were all greater than .85, and all inter-correlations were between .72 and .87,  $ps < .001$ . These high correlations suggest that experiential feelings and cognitive attributions of life meaning tap the same general phenomenon. The inhibition and approach factors were correlated,  $r(134) = -.23, p = .007$ , consistent with results in Study 1 and Corr's (2004) joint subsystems view of inhibition and approach processes as being reciprocally active.

In a two-step hierarchical regression using these three factors, meaning was first regressed onto approach motivation, yielding a significant model,  $F(1, 134) = 48.50, p < .001, R^2 = .36$ , and revealing a significant relationship between approach motivation and meaning,  $\beta = .60, p < .001$ <sup>1</sup>. Inhibition was added in the second step, and the model was significantly improved,  $F(2, 133) = 79.76, p < .001, \Delta R^2 = .19$ . Replicating the previous findings, when accounting for inhibition's contribution,  $\beta = -.45, p < .001$ , approach motivation maintained its significant relationship,  $\beta = .49, p < .001$ .

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<sup>1</sup> 12 participants missing from analysis because they did not complete relevant scales.

## **Discussion**

The Study 2a regression analysis replicated findings from Study 1a by demonstrating that the approach and inhibition factors both predict a large percentage of the variance in peoples reported meaning in life, with the approach factor again predicting more unique variance (36% vs. 19%). Overall, both inhibition and approach accounted for 55% of the variance in meaning scores. It also found that measures of felt meaning (the degree to which someone felt like their life was meaningful) and meaning-presence (the degree to which they thought their life was meaningful) were virtually identical, correlating at .72 or higher, indicating that people don't readily distinguish between meaning that is felt, as opposed to meaning that might be thought of as more "out there" in the world.

### **Study 2b**

Study 2b aimed to provide additional causal evidence linking approach motivation and meaning, while exploring the importance of significant values for meaning. To do this, Study 2b used an approach manipulation, asking people to think about something they want to enthusiastically approach, and a significant value manipulation, asking people to think about an important value which plays a cross-temporal role in their life goals (both past and future). Crucially, a meaning manipulation was added to see if approach and value manipulations would produce similar feelings of meaning when compared to a condition that explicitly asked participants to talk about what is most meaningful in their lives.

Moreover, to confirm that inhibition reduces meaning relative to approach motivation, a relationship threat was also included to induce incoherence and inhibition. This condition was anticipated to significantly differ from the other three manipulations. In Study 1c, it was speculated that approach motivation petering out after the manipulation might have been

responsible for the marginal effects found. To test this assumption, Study 2b used measures asking participants about their meaning at the time of the manipulation (e.g., “What I just described is of great importance to my life.”). It was expected that the within-condition differences in meaning would be more strongly mediated by approach motivation than inhibition. Overall, I hoped to further establish approach motivation’s role in inspiring meaning and in mediating any effects of manipulated meaning, incoherence, and enduring values on meaning.

## Methods

**Participants and design.** Study 2b relied on the identical sample and design as Study 1b. Two samples of undergraduate students were collected in the fall and winter semesters of the same academic year at the University of Waterloo using highly equivalent designs. Following the first round of data collection anticipated results for within-subject and regression analyses were preregistered (<https://osf.io/krz3b/>).<sup>1</sup> Results from the initial and pre-registered sub samples are presented in Appendix B.

Participants went through an online survey that spanned four sessions which were required to be at least 4 hours apart. In each session, participants were either prompted to think about something meaningful, something they eagerly wanted to approach, an important value, or a threatening relationship situation designed to increase inhibition and incoherence. A detailed account of full materials from the study are included in Appendix A.

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<sup>1</sup> Separated analyses for each sub sample is available in the Appendix B, along with a reporting of all pre-registered analyses and predictions. Trait felt meaning was used as a baseline condition in the within-subjects design, but then removed from the main reported analyses here despite confirming predictions. This was due to it being deemed not appropriate to serve as a baseline since it had a different wording relative to the retrospective meaning measures. Accordingly, Study 3 used a manipulated control condition using a similar within-subjects design.

**Within-subject manipulations.** Participants underwent four manipulations across the four sessions, but the ordering of the sessions was altered between the initial study (meaning manipulation, value affirmation, approach motivation manipulation, relationship threat) and the pre-registered study (relationship threat, approach motivation manipulation, value affirmation, meaning manipulation). The order was changed (with the relationship threat condition first, and then last) to ensure that expected differences between the relationship threat and other conditions could not be due to the order in which they were completed.

For the meaning manipulation, participants were prompted to describe something meaningful in their lives (“Please describe the most meaningful aspect of your life.”). Participants did something similar for the approach motivation manipulation (“Please describe something that you truly and eagerly want to approach—i.e., something that you genuinely and enthusiastically wish to move towards getting or having more of in your life.”). In the value affirmation, they first chose a value and then described how important it is (“Please describe the ways your selected value is important to you, and how you have acted according to this value in the past and plan to in the future”). Finally, for the relationship threat condition, which was meant to elicit inhibition, participants reported on a relationship that is not going well (“Think about a close relationship (family member, friend, or romantic partner) that is currently not going very well. For example, you may be fighting a lot lately, or may not be talking as much as you used to”).

**Within-subject dependent variables and mediators.** The main prediction was that meaning during manipulations of approach, meaning, and values would differ significantly from the relationships threat manipulation. In line with the hypothesized link between approach motivation and meaning, approach motivation, but not inhibition, was expected to mediate the

within-subject effects on meaning after the manipulations. Given the importance of significance to meaning, the value condition (eliciting significant values in one's life) would have similar influences on meaning when compared to the approach and meaning manipulations.

Immediately after each manipulation participants filled out measures of retrospective meaning (3 items; "What I just described is of great importance to my life.", "What I just described matters a lot to me.", "What I just described is central to my identity.");  $\alpha$ 's ranged from .71 to .85). These items attempted to capture the participant's meaning at the time of the manipulation by directly asking them about what they had described, which are in contrast to the Study 1c items which asked how much meaning they felt after the manipulation (e.g., "Right now, in the present moment, I understand my life's meaning"). In reaction to results from Study 1c, which found a marginal main effects of condition when manipulating approach motivation, it was speculated that this was due to the fleeting effects of approach motivation. As such, it was expected that this measure would better capture the effects of the within-subject manipulations and so it was the central variable of interest. Given prior investment in this explanation based on previous studies, this specific analysis was pre-registered.

Participants also filled out state Felt Meaning measures after each manipulation (4 items, e.g., [Right now, at this very moment] "My life feels meaningful.", "My life feels like it has clear purpose.", "My life feels like it makes sense.", "My life feels significant and like it matters.");  $\alpha$ 's ranged from .90 to .91) to see if the within-subjects effect persisted beyond the retrospective measures, despite results from Study 1c. The rigorous within-subjects design was thought to perhaps be better suited to capture these sorts of persistent effects. The items were also designed to be amenable to state ratings, whereas Study 1c used state version of the Meaning in Life scale which is typically used as a trait measure.

After each manipulation participants also reported state measures of BAS Drive (4 items, [at this very moment I feel like] “I would be fiercely determined in going after what I wanted”, “I would move on it right away if I saw a chance to get something I wanted.”, “I would go out of my way to get what I wanted.”, “I would be fiercely determined in going after what I wanted.”), BAS Reward (2 items, [at this very moment I feel like] “I would get excited right away if I saw an opportunity for something I liked.”, “I would feel excited and energized if I got something I wanted.”), Subjective Salience (4 items; “My worries feel urgent right now”, “My stress feels overwhelming right now.”, “My troubles feel desperate right now.”, “My problems feel big right now.”), and Felt Uncertainty (13 items, e.g., [at this very moment] “I feel uncertain.”, “I feel conflicted.”). Both state BAS scales were averaged for each manipulation to create an approach composite ( $\alpha$ 's ranged from .77 to .84) which was used in the mediational analysis. Subjective Salience and Uncertainty Aversion state scales were averaged for each manipulation to create an inhibition composite ( $\alpha$ 's ranged from .83 to .84) which was used in the mediational analysis.

## Results

**Within-subject analyses.** For the retrospective meaning analysis, Mauchly's test indicated that the assumption of sphericity was violated,  $W = .657, p < .001$ , therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon = .77$ ). A significant main effect indicated that felt meaning varied significantly across time,  $F(2.32, 287.33) = 116.12, MSE = .576, p < .001, \eta^2_p = .48$ . LSD post-hoc tests confirmed that retrospective meaning in the relationship threat condition ( $M = 3.13$ ) significantly differed from meaning when describing meaning in life ( $M = 4.44, p < .001$ ), when describing an important value ( $M = 4.51, p < .001$ ), and when describing something to approach ( $M = 4.25, p < .001$ ).



Retrospective meaning in the meaning condition significantly differed from the approach motivation condition ( $p = .012$ ), but not the value condition ( $p = .254$ ).

We also tested to see if the effect was robust enough to last for state felt meaning ratings a little while after the manipulation. Mauchly's test indicated that the assumption of sphericity was violated,  $W = .874$ ,  $p = .005$ , therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon = .92$ ). A significant main effect indicated that meaning varied significantly across time,  $F(2.05, 349.55) = 8.66$ ,  $MSE = .236$ ,  $p < .001$ ,  $\eta^2_p = .06$ . LSD post-hoc tests confirmed that state meaning in the relationship condition ( $M = 3.32$ ) significantly differed from meaning after describing meaning in life ( $M = 3.55$ ,  $p < .001$ ), after describing an important value ( $M = 3.60$ ,  $p < .001$ ), and after describing something to approach ( $M = 3.51$ ,  $p < .001$ ). State meaning in the meaning condition did not significantly differ from the approach condition or value conditions ( $ps > .449$ ).

**Mediational analyses.** To see if state measures of inhibition or approach best mediated the effects of meaning when contrasting the relationship threat condition with the other three conditions, the MEMORE macro for SPSS was used to test for within-subject mediational effects (Montoya & Hayes, 2017). The scores for retrospective meaning and felt meaning from the approach, meaning, and value manipulations were averaged to compare with the relationship threat condition. The state measures of inhibition as well as state measures of approach across those three conditions were also averaged to create composite scores to for the mediational analyses.

When looking at the mediational effects of the state measure of approach on retrospective meaning, a bias-corrected bootstrap confidence interval for the indirect effect ( $ab = .55$ ) based on 5,000 bootstrap samples didn't include zero (0.06 to 0.33). There remained a strong direct effect

( $c' = 0.71$ ,  $p < .001$ ;  $c = 1.27$ ,  $p < .001$ ). When conducting the same analysis but with state inhibition measures, the indirect effect ( $ab = .05$ ) included zero (-0.09 to 0.18).

To see if this effect held up for later measures of state felt meaning, a mediational analysis using the state measure of approach was conducted. Again, it was found that the indirect effect ( $ab = .10$ ) did not include zero (0.05 to 0.16), with the direct effect remaining significant ( $c' = 0.14$ ,  $p = .003$ ;  $c = 0.24$ ,  $p < .001$ ). A successful mediation was found for state inhibition this time using the same analysis, with the indirect effect ( $ab = .12$ ) not including zero (0.06 to 0.19), with the direct effect remaining significant ( $c' = 0.11$ ,  $p = .041$ ).

## **Discussion**

Study 2 results from the within-subject analysis found evidence that meaning is susceptible to manipulations of approach, values, and inhibition. Thinking about immediate concerns regarding incoherence in a relationship or about something to eagerly approach led to significantly different levels of meaning, confirming that inhibition and approach have divergent influences on meaning. Moreover, the approach and values conditions produced similar levels of meaning compared to a direct meaning manipulation. Only for the retrospective measures of meaning did the approach motivation condition diverge significantly from the meaning condition, while it did not differ for later state levels of meaning. This initial divergence could be due to the approach manipulation tapping into purpose, but not significance. The values manipulation asked people to think about how their past and future goals are informed by their significant values, inducing thoughts about their goals and about how they relate to their enduring values.

The mediational analysis further suggested that approach motivation is a strong underlying mechanism giving rise to these effects, as it's consistently mediating meaning effects both retrospective and state levels of meaning. Inhibition was found to only mediate the state measures of meaning after the manipulation. Study 3 looked to replicate this finding to see if mediational effects of inhibition are robust.

### **Study 3a**

All data for Study 3 was collected over five sessions as part of a larger study. As in Study 2, each session involved participants filling out personality measures and undergoing one within-subject manipulation. Trait measures were measured once throughout the design, and state measures were measured after every within-subject manipulation (five measures each). A detailed account of full materials from the study are included in Appendix A. Study 3a looked to replicate the Study 1a and Study 2a regression findings once.

### **Methods**

**Participants and procedure.** Seventy-seven undergraduates (67 female; 1 missing,  $M_{age} = 21.89$ ) were recruited to participate in an online survey that spanned five sessions. A detailed account of full materials from the study are included in Appendix A.

#### **Measures used to replicate Study 1a and Study 2a.**

**Inhibition measures.** Study 3a used a similar procedure to Study 2a. The Perceived Stress Scale, Subjective Salience (state and trait), Felt Uncertainty (trait), and Neuroticism scales were not included. Instead, measures of Need for structure (Neuberg & Newsom, 1993, 12 items; e.g., "I hate to be with people who are unpredictable.") and an additional measure of BIS (Reinforcement Sensitivity Scale (RST); Corr & Cooper, 2016; 24 items, e.g., "I would be very

cautious traveling in a foreign country for the first time.”). The same procedure was used from Study 2 to elicit participant’s ratings on the extent to which their goals were inhibition-prone. All scales were again entered into a principal components analysis and the first factor score was saved.

**Approach measures.** Study 3a added an additional measure of BAS (RST; Corr & Cooper, 2016; 23 items, e.g., “I am very persistent in achieving my goals.” ) and hope (Snyder et al., 1991; 8 items, e.g., "I can think of many ways to get the things in life that are most important to me."). All other procedure was identical to Study 2.

**Meaning measures.** Procedure from Study 2 is identical except no trait or state measure of Felt Meaning was measured. State retrospective meaning measures after each within-subject manipulation (discussed further in Study 3b) were also changed from Study 2 (4 items; e.g., [Regarding what I just described] “It feels meaningful”, “It makes my life feel significant”). (See Table 3 for intercorrelations between all approach, inhibition and meaning variables).

Table 3  
Correlations for Trait and State Approach, Inhibition, and Meaning Measures for Study 3

Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. BAS	-																
2. Approach Motivation	.551***	-															
3. Locomotion	.621***	.666***	-														
4. Hope	.549***	.694***	.734***	-													
5. RST BAS	.690***	.723***	.819***	.773***	-												
6. Approach States	.333**	.493***	.512***	.556***	.545***	-											
7. Approach Goals	.396***	.565***	.376***	.455***	.424***	.385***	-										
8. Uncertainty Aversion	-.170	-.283**	-.282**	-.499***	-.216*	-.250*	-.258*	-									
9. Rumination	.085	-.111	-.127	-.338**	-.089	-.162	-.144	.584***	-								
10. Attachment Anxiety	-.029	-.150	-.234*	-.429***	-.163	-.120	-.232*	.713***	.627***	-							
11. BIS	-.093	-.160	-.189	-.390***	-.194	-.125	-.139	.685***	.603***	.711***	-						
12. Personal Need for Structure	-.117	-.069	-.026	-.144	-.104	-.096	-.146	.553***	.199	.346**	.411***	-					
13. RST BIS	-.091	-.197	-.302**	-.468***	-.208*	-.217*	-.238*	.706***	.793***	.716***	.677***	.228*	-				
14. Inhibition States	.042	-.221*	-.271**	-.371***	-.195	-.315**	-.175	.571***	.525***	.520***	.361***	.163	.633***	-			
15. Inhibition Goals	-.103	-.278**	-.238*	-.294**	-.196	-.139	-.436***	.372***	.283**	.302**	.217*	.252*	.405***	.333**	-		
16. Meaning Presence	.223*	.414***	.368***	.526***	.339**	.228*	.300**	-.537***	-.441***	-.584***	-.461***	-.155	-.504***	-.464***	-.129	-	
17. Meaning States	.219*	.383***	.357***	.324**	.292**	.542***	.303**	-.118	-.039	.047	.013	.056	-.127	-.087	-.133	.266**	-
18. Meaning Goals	.269**	.407***	.209*	.341***	.237*	.255*	.756***	-.273**	-.112	-.258*	-.180	-.198	-.156	-.016	-.393**	.234*	.259*

Note. \*  $p < .05$  \*\*  $p < .01$ . \*\*\*  $p < .001$ .

## Results

**Studies 1a and 2a replication.** The three principal components analyses revealed the expected single-factor solutions for inhibition, approach, and meaning with all expected loadings above .45, and with the first factor in each case accounting for 57%, 66%, and 58% of variance, respectively. None of the other relative factors in any of the analyses accounted for more than 23% of the variance. The inhibition and approach factors were again significantly correlated,  $r(74) = -.42, p < .001$ .

In a two-step hierarchical regression, meaning was first regressed onto approach motivation, yielding a significant model,  $F(1, 73) = 63.94, p < .001, R^2 = .47$ , and revealing a significant relationship between approach motivation and meaning,  $\beta = .68, p < .001$ <sup>1</sup>. Inhibition was added in the second step, and the model was significantly improved,  $F(2, 72) = 39.04, p < .001, \Delta R^2 = .05$ . This again replicated previous findings: when accounting for inhibition's contribution,  $\beta = -.26, p = .006$ , approach motivation maintained its significant relationship,  $\beta = .58, p < .001$ .

## Discussion

Study 3a again replicated the Study 1a and 2a regression findings, showing a robust relationship between approach and inhibition on meaning, with approach explaining the bulk (36%) of the accounted 45% of variance in meaning.

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<sup>1</sup> 3 participants missing from analysis due to subjects not completing relevant scales.

## Study 3b

Study 3b extended the within-subjects findings in Study 2b by including a baseline control condition.

### Methods

**Participants and procedure.** The expected results were pre-registered for the within-subject analysis (<https://osf.io/mey64/>). An a priori sample power analysis for was conducted using a modest effect size (0.20), which resulted in a recommended sample size of thirty-three. As with Study 3a, seventy-seven undergraduates (67 female; 1 missing,  $M_{age} = 21.89$ ) were able to participate in an online survey that spanned five sessions. A detailed account of full materials from the study are included in Appendix A.

**Within-subject manipulations, dependent variables and mediators.** Methods used for Study 3b were largely identical to Study 2b, however now there was a within-subjects baseline condition in a fifth session where participants were asked to talk about what they do on a typical day (“Please describe the typical daily routine that you tend to go through on a regular day”). Furthermore, participants went through the manipulation in the following order: relationship threat, meaning, approach, values, baseline (typical day).

For the primary dependent variable, no state felt meaning was included and participants were asked to answer new questions about retrospective meaning to better capture how they felt during the manipulation (4 items; “Regarding what you just described, please rate your agreement with the following statements”; “It feels purposeful”, “It makes sense to me”, “It feels meaningful”, “It makes my life feel significant”;  $\alpha$ 's ranged from .85 to .91). Moreover, for the mediational analyses, no Subjective Salience measures were included, and so Felt Uncertainty measures now acted as the state inhibition measure after each manipulation ( $\alpha$ 's ranged from .92

to .97). As in Study 2b, both state BAS Drive and Reward scales were averaged for each manipulation to create an approach composite ( $\alpha$ 's ranged from .94 to .96)

## Results

**Within-subject analysis.** Mauchly's test indicated that the assumption of sphericity was violated,  $W = .47, p < .001$ , therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon = .76$ ). A significant main effect indicated that felt meaning varied significantly across time,  $F(3.03, 227.02) = 75.75, MSE = .626, p < .001, \eta^2_p = .50$ . LSD post-hoc tests confirmed that baseline meaning rating ( $M = 3.25$ ) significantly differed from meaning when describing a relationship threat ( $M = 2.96, p = .023$ ), when describing something to approach ( $M = 4.18, p < .001$ ), when describing an important value ( $M = 4.31, p < .001$ ), and when describing meaning in life ( $M = 4.36, p < .001$ ). Replicating Study 2 findings, the relationship threat condition varied significantly from the other three manipulated conditions (all  $p$ 's  $< .001$ ; See Figure 2). Meaning in the meaning condition significantly differed from the approach motivation condition ( $p = .014$ ), but not the value condition ( $p = .461$ ).

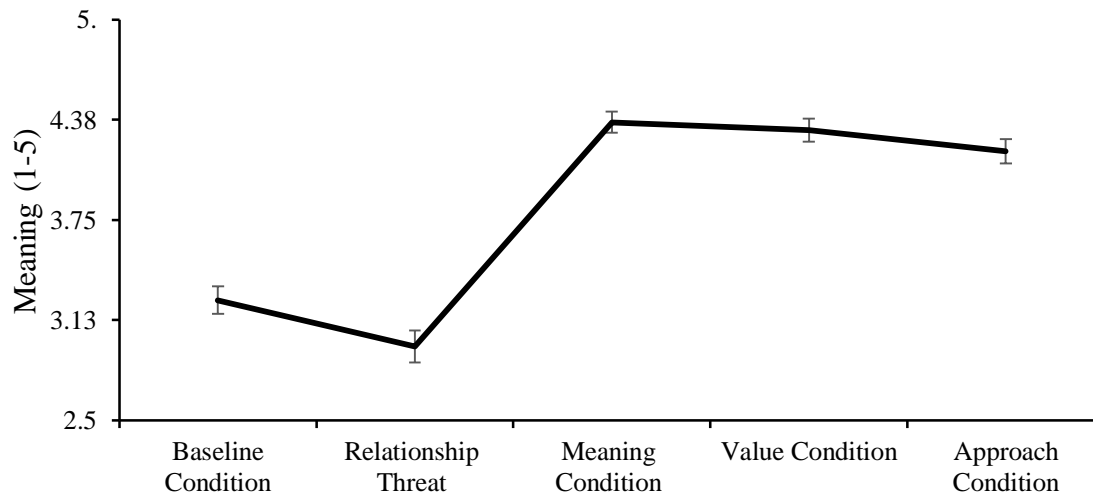


Figure 2. Study 3b within-subject manipulation results. Error bars reflects standard error.



**Mediational analyses.** To see if inhibition or approach best mediated this effect, I used the MEMORE macro for SPSS to test for within-subject mediation effects (Montoya & Hayes, 2017). As with Study 2, the scores for retrospective meaning from the approach, meaning, and value manipulations were averaged. In contrast to Study 2, measures of retrospective meaning for these condition were compared to the baseline condition. The state measures of inhibition and approach across those three conditions were also averaged.

When looking at the mediational effects of state measures of approach on meaning, a bias-corrected bootstrap confidence interval for the indirect effect ( $ab = .48$ ) based on 5,000 bootstrap samples didn't include zero (0.16 to 0.83). There remained a strong direct effect ( $c' = 0.55$ ,  $p < .001$ ;  $c = 1.03$ ,  $p < .001$ ). When conducting the same analysis but with state inhibition measures, the indirect effect ( $ab = -.00$ ) included zero (-0.06 to 0.06).

## **Discussion**

Study 3b replicated findings from Study 2b and extended them by showing that meaning did fluctuate relative to a baseline in response to the manipulations and that only approach motivation, and not inhibition, mediated effects of approach, values, and meaning relative to the baseline condition. Moreover, the meaning condition was found to differ from the approach condition, but not from significant value condition, reinforcing the importance of thinking about the alignment with enduring cross-temporal values for meaning.

The regression findings were replicated once again, showing a robust relationship between approach and inhibition on meaning, with approach explaining the bulk (36%) of the accounted 45% of variance in meaning.

## CHAPTER 3: GENERAL DISCUSSION

The current studies provide converging evidence supporting the hypothesis that approach motivation gives rise to meaning. Studies 1a, 2a, and 3a all found that diverse trait and state measures of approach (representing both immediate and enduring elements) significantly predicted meaning over and above inhibition, with approach motivation consistently emerging as the more powerful predictor of meaning. Moreover, the association between approach and meaning held when controlling for positive affect in Study 1a, showing that approach motivation provides a unique and, arguably, more fundamental substrate for meaning. Genetic evidence in Study 1b further suggested approach motivation's role in predicted meaning by showing that it was associated with DRD4 variants related to increased dopaminergic activity, an effect that again held when controlling for positive affect. Approach motivation mediated the relationship between DRD4 variants and meaning. This suggested that a predisposition to engage in goal-directed behaviour encourages enduring levels of purpose, leading to meaning.

This thesis also presented experimental evidence: Study 1c found that manipulations of approach motivation in a between subject's paradigm led to increased meaning relative to a free thought control condition. More robust tests came in the form of two pre-registered within-subjects analyses for Study 2b and 3b. Meaning, values, and approach manipulations significantly differed relative to inhibition (Study 2b) and baseline (Study 3b) conditions in terms of meaning. These differences were consistently mediated by approach motivation, but not by inhibition. Across the two studies, the meaning conditions did not differ from the significant values conditions, and diverged from approach motivation for retrospective measures of meaning. This reinforcing the view that people need to not only be pursuing goals, but to see those goals as being in alignment with significant values in their lives for meaning. Overall,

these manipulation designs show the influence of immediate levels of approach and inhibition on meaning.

Taken together, these findings provide evidence for the present proposal that approach motivation gives rise to meaning and that significant values play an important role in feelings of meaning.

### **Approach Motivation as the Substrate for Meaning**

The centrality of approach motivation for meaning offers an opportunity to integrate the divergent contributors of meaning identified in the literature (coherence, significance, purpose), while also reconciling traditional ideas of meaning as being rooted in the pursuits of a virtuous life with the evidence showing that subtle in-lab manipulations alter meaning.

Enduring forms of coherence, significance, and purpose help shape people's lives, informing what values they pursue and the worldviews they subscribe to. Values related to spirituality, virtue, and benevolence might serve as important anchors for people, constantly providing a significant purpose that helps pull people onwards, inspiring eager enthusiasm and meaning. For example, those highly devoted to religion report chronically lower levels of inhibition and higher levels of meaning (Ivtzan, Chan, Gardner, & Prashar, 2013; Lim & Putnam, 2010; Newport, Agrawal, & Witters, 2010). Many have speculated that these effects could be due to factors like religion's protective, guiding worldview (coherence; Vail et al., 2010), its ability to boost efficacy through trust in divine aid (purpose; Khenfer, Roux, Tafani, & Laurin, 2017), and its inspiring values that cloak life with cosmic significance (significance; Emmons, 2005). Indeed, in a review of how religion influences meaning, Emmons (2005) concluded that the "pursuit of personally significant goals in general, and goals of a religious and spiritual nature in particular, can contribute to positive experience and the construction of life

meaning” (p. 732). Therefore, traditional sources of meaning like religion can provide meaning through their ability to streamline approach motivated goal pursuit by contributing to enduring sources of coherence, purpose, and significance.

As important as these enduring sources of meaning are, immediate levels of coherence, purpose, and significance can have an effect on meaning. Exposing people to unnatural patterns (coherence; Heintzelman et al., 2013), boosting their optimism about goal success (purpose; Van Tongeren et al., 2018), and getting them to think about significant values (significance, this study) have all been shown to influence levels of meaning in lab settings. The present study showed how similar shifts can be found when directly manipulating approach motivation and that approach motivation mediates effects of these lab manipulations on meaning. These state changes in meaning reflect a shift in one’s ability to activate approach motivation, thus shifting people’s enthusiasm for the pursuit of significant values in their lives.

Taken together, this theoretical perspective can illuminate the mechanism whereby diverse influences act on meaning by either enhancing or hindering approach motivation.

### **Meaning and Happiness**

How would this relate to the relationship between happiness and meaning? Can hedonistic pursuits that are not geared towards prosocial values be a source of meaning in life? A vast literature has articulated an important theoretical and empirical distinction between hedonic pursuits, characterized by seeking pleasure in one’s activities, and eudaemonic pursuits, characterized by a focus on guiding values that orient people’s life towards something of ultimate significance (e.g., Baumeister et al., 2013; Huta & Ryan, 2010; Keyes et al., 2002; Richard M. Ryan & Deci, 2001; Ryff, 1989; Ryff & Singer, 1998). This would be consistent

with the importance of significance for meaning and the present findings that values confer a sense of meaning comparable to that of directly manipulating meaning itself.

Despite this precedent, meaning and happiness are highly correlated (between .5 and .7 Baumeister et al., 2013; King et al., 2006) and past work by McGregor and Little (1998) found that having hedonistic approaches to life did not hinder people's meaning when compared to those who had more communal motives. The answer to this inconsistency perhaps lies in the degree to which people consider hedonism and self-congratulatory adulation as the ultimate value in life, rendering ongoing hedonistic pursuits as meaningful. It might be enough for many to be content with their lives as approaching a significant legacy of hedonism, subscribing to the 'eat, drink, and be merry' school of thought. If this were the case, hedonistic pursuits would be sufficient to satisfy people's needs for significance, dovetailing happiness and meaning. While these hedonistic indulgences may be sufficient for some, they might be vulnerable to adversity (death and separation) and habituation when compared to more robust transcendent values. Indeed, Klinger (1977) proposed that values which are more spiritual and other-oriented (e.g., justice, benevolence) are available to anyone to pursue by providing multiple avenues towards achievement (e.g., small acts of kindness) and lack habituation due to them requiring unending persistence. Therefore, over time, people might move towards more prosocial eudaemonic values to characterize their significant values in life, thus untethering meaning from happiness.

### **Limitations and Future Directions**

While my work provides important first steps towards integrating work on meaning, some limitations require further research. These studies mostly relied on self-reported measures of approach motivation and the sample drew exclusively from undergraduate university samples.

Future work needs to employ behavioural or neuropsychological measures and replicate the effects using more nationally and cross-culturally representative samples. Of interest to the discussion on meaning and positive affect — looking at longitudinal designs would offer a developmental insight at how sources of meaning evolve across the lifespan. This would speak to whether people turn to more durable eudaemonic values when hedonistic indulgences are met with harsh realities or become habituated.

Relating to more applied implications of this work, approach motivation has been associated with a range of emotions (Harmon-Jones et al., 2013), and is linked to a variety of potentially harmful behaviours, like consumption of drugs and alcohol (McGregor et al., 2013). In the light of the present research, these might be seen as maladaptive attempts at establishing a sense of meaning (Jonas et al., 2014). For example, approach motivation has been linked to a variety of different affective states like power (Keltner et al., 2003), aggression (Carver & Harmon-Jones, 2009), and happiness (Carver & Scheier, 1998). These could represent various ways people look to gain the experience of meaning, as argued in the case of happiness. Relating to aggression, recent evidence has found that having inter-group conflict helps galvanize people and provides meaning (Rovenpor et al., 2017), indicating that a clear enemy that serves as a punching bag for aggression offers moral clarity and a strong sense of meaning (Kruglanski, Jasko, Webber, Chernikova, & Molinario, 2018). Future research could look to see exactly how to leverage these emotions towards better channels as a way of gaining meaning.

Present findings can also speak to clinical work. While deconstructing the past might lead to insights that provide coherence, approaches that emphasize life goals that represent significant and engaging values might be especially helpful for individuals trying to regain meaning. By boosting approach motivation, these approaches can also result in coherence along the way

through approach motivation's ability to inspire positive emotions and re-framing of one's life (Fredrickson & Joiner, 2002; Pennebaker & Seagal, 1999). Supporting this idea, previous work suggests that encouraging individuals to engage in meaningful goals, such as volunteering, helps to boost longevity and quality of life (Cohen, Bavishi, & Rozanski, 2016; George & Whitehouse, 2010). Future work should look at the therapeutic effects of exploring goal pursuits that reflect values people would like to see reflected in their lives.

### **Conclusion**

Meaning in life is fundamental to health and well-being. The results of these studies suggest that coherence, purpose, and significance contribute to meaning by either enhancing or hindering approach motivation. This highlights the importance of the goals we approach, and makes picking what is worth pursuing a central question for meaning in life.

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## APPENDIX A

### Study 1

#### Session 1

Session was completed online. After filling out demographic items (e.g. age, gender) participants completed the following trait measures: Horizontal Dimension of Individualism – Collectivism Scale (Komarraju & Cokley, 2008), Meaning in Life Questionnaire (Steger, Frazier, Oishi, & Kaler, 2006), Rational – Experiential Inventory (Epstein, Pacini, Denes-Raj, & Heier, 1996), International Personality Item Pool – Five – Factor Model (Goldberg, 1999), Approach Motivation (Lockwood, Jordan, & Kunda, 2002), Experiences in Close Relationships Scale (Brennan, Clark, & Shaver, 1998) and Brief Self – Control Scale (Tangney, Baumeister, & Boone, 2004).

Participants were randomly assigned to think and write about an experience, activity or period in their lives that either felt very meaningful (or meaningless in the control condition) for 90 seconds. Afterwards, they spent another 90 seconds describing what they were thinking and feeling while writing about the experience. Following the manipulation, everyone filled out state version of the BAS scale (Carver & White, 1994) and PANAS (Watson, Clark, & Tellegen, 1988). Next, subjects completed a Personal Projects Analysis Dimensions measure (Little, 1989) and the meaning manipulation check followed by the following personality scales: Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983), Center for Epidemiological Studies Depression Scale (Radloff, 1977), Rumination Subscale (Trapnell & Campbell, 1999), Emotional Uncertainty Response Scale (Greco & Roger, 2001), Hypomanic Personality Scale (Eckblad & Chapman, 1986), Affect Dimension of the Three Dimension Wisdom Subscale (Ardelt, 2003), select items from Marlowe – Crowne Social Desirability Scale (Crowne &



Marlowe, 1960), Revised Paranormal Beliefs Scale (Tobacyk, 2004), Aggression Questionnaire (Buss & Perry, 1992), and State-Trait Anger Expression Inventory (Spielberger, Sydeman, Owen, & Marsh, 1999). At the end, everyone filled out a conscientiousness of responding check.

## **Session 2**

Session was completed in lab. Participants again filled out some demographic items (e.g. age, gender, ethnicity) followed by a number of personality measures: Rosenberg Self – Esteem Scale (Rosenberg, 1965), Ten Item Personality Inventory (Gosling, Rentfrow, & Swann Jr, 2003), and Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985). Afterwards, they filled out a state version of PANAS (Watson et al., 1988) and were randomly assigned to either write about something that they eagerly desired or their thoughts as they engaged in free thought. The screen auto advanced in each condition after 2 minutes. Afterwards, subjects were assigned to another manipulation – one of six prime conditions: competition, approach, cooperation, free thought, religion and control. In each condition they had to unscramble 10 four-word sentences relating to the semantic content of each prime. Following the sentence unscrambling task, everyone filled out a state version of the BAS sub-scale (Carver & White, 1994) and were asked to close their eyes for a minute while their brain activity was recorded. Then, participants filled out state PANAS (Watson et al., 1988) a second time followed by two measures of pro-social giving - Social Values Orientation and York Cares. For the Social Values Orientation, participants were asked to distribute a hypothetical amount of money between themselves and an imaginary other person, while in the York Cares to donate to a controversial university Muslim student organization. Following another one-minute brain recording, participants were assigned to either a high or low values manipulation (Fein & Spencer, 1997; Steele, 1988) followed by another one-minute brain recording segment, some additional writing

about their chosen value, a final one-minute brain recording segment and a values manipulation check. Afterwards, they were provided with a hypothetical scenario about various types of criminals (e.g. corporate, terrorists) and were asked to indicate their endorsement of different forms of punishment for these individuals. Finally, they completed the state Felt Uncertainty scale (McGregor, Zanna, Holmes, & Spencer, 2001) and a conscientiousness of responding check.

### **Session 3**

Session was completed online. Participants first filled out demographic items (e.g. age, gender, English language fluency) followed by two trait questionnaires: Personal Need for Structure (Neuberg & Newsom, 1993) and Preference for Consistency (Cialdini, Trost, & Newsom, 1995). Then they were assigned to one of three conditions: approach motivation, avoidance motivation, and a control free thought prime. Each manipulation continued for two minutes. In the free thought prime condition subjects were instructed to let their mind wander and record any passing thoughts. In the approach participants were asked to think and write about something they eagerly desired, and in the avoidance to think and write about something they wanted to avoid.

After the manipulation, everyone completed the state versions of the following measures: Hedonic and Eudaemonic Motives for Activities (Huta & Ryan, 2010), Meaning in Life scale (Steger et al., 2006), Reading the Mind in the Eyes Test (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997), Mind in Eyes conscientiousness check, and Felt Uncertainty Scale (McGregor et al., 2001). Afterwards, subjects were assigned to another manipulation: A relationship threat or a control condition (McGregor & Marigold, 2003) followed by a corresponding manipulation check. They then filled out the Wise Reasoning Scale (adapted from Huynh, Oakes, Shay, &

McGregor, 2017), state PANAS (Watson et al., 1988) religious identification, Religious Zeal (McGregor, Nash, Mann, & Phills, 2010), Religious Conviction (Personal and Group level) and Intrinsic Religiosity (Allport & Ross, 1967). Afterwards, they completed further personality measures: Social Dominance Orientation (Pratto, Sidanius, Stallworth, & Malle, 1994), Narcissistic Personality (Raskin & Hall, 1979), Hope (Snyder et al., 1991), Generalized Self Efficacy (Schwarzer & Jerusalem, 1995), Personal Sense of Power (Anderson, John, & Keltner, 2012), Vitality (Ryan & Frederick, 1997), Authenticity (Wood, Linley, Maltby, Baliouis, & Joseph, 2008), Unified Motives Scales (Schönbrodt & Gerstenberg, 2012), Philadelphia Mindfulness (Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008) and conscientiousness of responding check.

#### **Session 4**

Session was completed in lab. Participants were brought in and buccal samples were collected for DNA analysis.

### **Study 2**

Data for Study two was collected in eight parts at University of Waterloo. Parts one to four were collected in the fall term and parts five to eight during the winter. The order of the sessions was reversed in the winter term to make sure that the results were not affected by it. The winter surveys were identical to the ones done in the fall, except for a few minor changes outlined under the Winter Term section below. All parts done in the fall began with demographic information (age and gender) and ended with a 5-item conscientiousness of responding check.

#### **Fall Term**

**Session 1 - Meaning.** The session began with subjects filling out a number of trait measures: Felt Uncertainty, Subjective Salience, BAS Reward Responsiveness, BAS Drive, Felt Meaning, full BIS/BAS scales, Meaning in Life Questionnaire, Hedonic and Eudaemonic Motives for Activities, Personal Need for Structure, Preference for Consistency, Rational – Experiential Inventory, Perceived Stress Scale, Center for Epidemiological Studies Depression Scale, Rumination Subscale, Emotional Uncertainty Response Scale, Big Five Aspects Scales and Social Desirability. Participants were then asked to describe the most meaningful aspect of their lives for 90 seconds, followed by retrospective measures of meaning, approach motivation and abstraction/concreteness. Then participants filled out state versions of the first five scales they completed at the beginning of the session.

**Session 2 - Values.** The session started with subjects filling out the following measures: Personal Projects Analysis Dimensions, Rosenberg Self-Esteem, Brief Self Control, Vitality, Authenticity, Adult Hope, Generalized Self-Efficacy and Personal Sense of Power. Afterwards, participants were asked to choose their most important value from a list and then write for 90 seconds about why and how the value plays out in their lives. This was followed by retrospective measures of meaning, approach motivation and abstraction/concreteness This was followed by state versions of the following measures: Felt Uncertainty, Subjective Salience, BAS Reward Responsiveness, BAS Drive, and Felt Meaning. Thereafter, participants indicated how many years they wanted and expected to live and the extent to which criminals from the scenario in Study 1 Session 2 should be punished. Following the scenario, they completed some additional measures: General Regulatory Focus Measure, Regulatory Focus Questionnaire and Regulatory Mode.

**Session 3 - Approach.** The session started with subjects filling out a battery of personality measures: Approach Motivated Sensitivity and Anxious Uncertainty Sensitivity scales, Narcissistic Personality Inventory, Belief in Meaning scale, Philadelphia Mindfulness scale, Hypomania scale, an unpublished scale about how one perceives being understood by people generally and a significant other in particular, Self Compassion Scale (Neff, 2003) and Generativity. Afterwards, everyone was asked to write for 90 seconds and describe something they truly and eagerly wanted to approach, followed by retrospective measures of meaning, approach motivation and abstraction/concreteness. Then participants filled out state versions of Felt Uncertainty, Subjective Salience, BAS Reward Responsiveness, BAS Drive and Felt Meaning. Finally, participants indicated their endorsement of Trump's presidency following Social Dominance Orientation and Right-Wing Authoritarianism scales.

**Session 4 – Relationship threat.** The session started with participants completing three personality scales: Horizontal Individualism Collectivism, Boredom Proneness and Experiences in Close Relationships. Everyone was then asked to think about a close relationship that was not going very well and write for 90 seconds about the associated problems and difficulties. Afterwards, subjects were asked to describe their thoughts and feelings as they imagined the possibility of this relationship continuing to go poorly for another 90 seconds. This was followed by retrospective measures of meaning, approach motivation and abstraction/concreteness and then state versions of Felt Uncertainty, Subjective Salience, BAS Reward Responsiveness, BAS Drive and Felt Meaning, just as in the other previous three parts. Next, subjects indicated their religious affiliation and proceeded to fill out the following: Religious Conviction (Personal and Group), Religious Zeal, Religious Belief Perceived Agreement and God Cares, Affect

Dimension of the Three Dimension Wisdom subscale, Wise Reasoning Scale, STAXI and the Aggression Questionnaire.

### **Winter Term**

Similar scales as in the fall terms were used unless otherwise indicated. Identical manipulations were used as in the fall term.

**Session 1 – Relationship threat.** The following scales were dropped: Religious Affiliation, all religion related scales, STAXI and Aggression Questionnaire. These measures were appended following the Wise Reasoning scale: Perceived Parental Support (Kocayörük, Altıntaş, & İçbay, 2015), Honesty-Humility (Ashton & Lee, 2009), Short Dark Triad-Machiavelianism (Furnham, Richards, & Paulhus, 2013), and Perfectionism (Hewitt, Flett, Turnbull-Donovan, & Mikail, 1991). In addition, at the end subjects were instructed to write about three different topics (turning point in life, important moral issue and important decision) and then indicate how each related to different life domains.

**Session 2 – Approach.** The following scales were dropped: Approach Motivated Sensitivity and Anxious Uncertainty Sensitivity.

**Session 3 – Values.** One scale was dropped: Personal Sense of Power.

**Session 4 – Meaning.** STAXI, Aggression, and religion related scales were appended here. They were inserted following items which indicate whether the meaning manipulation they wrote about was abstract/concrete, important and eagerly desired.

### **Study 3**

Data for Study 3 was collected in five parts during the spring term. The order of the sessions was changed again and a few minor modifications were made to each survey part (compared to Study 2). Conscientiousness of responding check was dropped from all sessions. Also, the demographic information was dropped from all but one session. After each manipulation state versions of Felt Uncertainty, Subjective Salience, BAS Reward Responsiveness, BAS Drive and Felt Meaning and items measuring the extent to which what they wrote about was abstract/concrete, important to them and eagerly desired remained the same as in Study 2 except for Subjective Salience which was dropped along with one item from the Felt Uncertainty scale (“I feel uneasy”). Nine new state items were added post manipulation, aimed at measuring state boredom and self control.

#### **Session 1 – Relationship Threat**

Two new measures were added following the Experiences in Close Relationships scale: Children’s Intrinsic Needs Satisfaction (Véronneau, Koestner, & Abela, 2005) and a number of items gauging intentions to drop out of university. Parental support scale and writing about important life decisions were dropped.

#### **Session 2 – Meaning**

Trait version of all state scales and items were dropped (a neutral control condition made these obsolete), as well as all religion related scales.

#### **Session 3 – Approach**

The following measures were dropped: Belief in meaning scale, an unpublished scale about how one perceives being understood by people generally and by a significant other in particular. Personal Project Analysis Dimensions were added following the Philadelphia Mindfulness scale.

#### **Session 4 – Values**

The following scales were removed: Personal Project Analysis Dimensions and years of desired and expected life. Grit scale (Duckworth, Peterson, Matthews, & Kelly, 2007) was added following the Brief Self Control measure.

#### **Session 5 – Baseline**

First, subjects filled out the Reinforcement Sensitivity Theory of Personality Questionnaire (Corr & Cooper, 2016). They were then asked to describe their typical daily routine for 90 seconds. All religion related scales were inserted here, followed by conscientiousness of responding check and demographics.

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## APPENDIX B

Results include baseline conditions using trait measures of felt meaning.

### Fall Term

For the retrospective meaning analysis, Mauchly's test indicated that the assumption of sphericity was violated,  $W = .549$ ,  $p < .001$ , therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon = .78$ ). A significant main effect indicated

that meaning varied significantly across time,  $F(2.74, 254.21) = 82.90$ ,  $MSE = .588$ ,  $p < .001$ ,  $\eta^2_p = .48$ . LSD post-hoc tests confirmed that meaning in the relationship condition ( $M = 3.17$ ) significantly differed from meaning after describing an important value ( $M = 4.61$ ,  $p < .001$ ), and after describing something to approach ( $M = 4.23$ ,  $p < .001$ ), and after describing something meaningful ( $M = 4.38$ ,  $p < .001$ ). Meaning differed significantly between the meaning condition and the values condition ( $p = .001$ ), and marginally in the approach condition ( $p = .078$ ). Using trait felt meaning as the baseline ( $M = 3.34$ ), it differed from the meaning, approach, and values conditions (all  $ps < .001$ ), but not the relationship threat condition,  $p = .153$ ).

For the state meaning measures, Mauchly's test indicated that the assumption of sphericity was violated,  $W = .833$ ,  $p = .043$ , therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon = .91$ ). A significant main effect indicated that meaning varied significantly across time,  $F(2.74, 254.21) = 6.00$ ,  $MSE = .250$ ,  $p < .001$ ,  $\eta^2_p = .06$ . LSD post-hoc tests confirmed that state meaning in the relationship condition ( $M = 3.30$ ) significantly differed from meaning after describing an important value ( $M = 3.60$ ,  $p < .001$ ), and after describing something to approach ( $M = 3.49$ ,  $p = .002$ ), but not after describing something meaningful ( $M = 3.39$ ,  $p = .274$ ). State meaning significantly differed from the meaning condition compared to the values condition ( $p = .012$ ), but not the approach condition ( $p = .126$ ). Using trait felt meaning as the baseline ( $M = 3.34$ ), it only differed from the values ( $p < .001$ ) and approach ( $p = .023$ ) conditions.

### **Winter Term (Pre-registered Sample)**

For the retrospective meaning analysis, Mauchly's test indicated that the assumption of sphericity was violated,  $W = .475$ ,  $p < .001$ , therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon = .71$ ). A significant main effect indicated

that meaning varied significantly across time,  $F(2.85, 165.38) = 41.18$ ,  $MSE = .702$ ,  $p < .001$ ,  $\eta^2_p = .42$ . LSD post-hoc tests confirmed that meaning in the relationship condition ( $M = 3.18$ ) significantly differed from meaning ( $M = 4.50$ ), approach ( $M = 4.31$ ), and values conditions ( $M = 4.40$ ; all  $ps < .001$ ). Meaning differed marginally between the meaning condition and the values condition ( $p = .081$ ), but not the approach condition ( $p = .325$ ). Using trait felt meaning as the baseline ( $M = 3.54$ ), it differed from the meaning, approach, and values conditions (all  $ps < .001$ ), and marginally for the relationship threat condition,  $p = .053$ ).

For the state meaning measures, Mauchly's test indicated that the assumption of sphericity was violated,  $W = .596$ ,  $p = .001$ , therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon = .79$ ). A significant main effect indicated that meaning varied significantly across time,  $F(3.20, 188.61) = 5.16$ ,  $MSE = .219$ ,  $p < .001$ ,  $\eta^2_p = .08$ . LSD post-hoc tests confirmed that state meaning in the relationship condition ( $M = 3.30$ ) significantly differed from meaning after describing an important value ( $M = 3.58$ ,  $p < .001$ ), and after describing something to approach ( $M = 3.53$ ,  $p = .003$ ), and after describing something meaningful ( $M = 3.62$ ,  $p = .001$ ). State meaning significantly did not differ when compared to the approach and values conditions ( $ps > .331$ ). Using trait felt meaning as the baseline ( $M = 3.54$ ), it only differed from relationship condition ( $p = .002$ ) and not for the other three conditions ( $ps > .331$ ).