Meaning in Life and Intuition

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Abstract

Three correlational studies and 2 experiments examined the association between meaning in life (MIL) and reliance on intuitive information processing. In Studies 1-3 (total $N = 5,079$) Faith in Intuition (FI) and MIL were correlated positively, controlling for religiosity, positive mood, self-esteem, basic need satisfaction, and need for cognition. Two experiments manipulated processing style. In Study 4 ($N = 614$), participants were randomly assigned to complete the Cognitive Reflection Task (CRT; Fredrick, 2005) either immediately prior to (reflective/low intuitive mindset condition) or immediately after (control condition) rating MIL. Condition did not affect MIL. However, low MIL rated prior to the CRT predicted superior performance and greater time spent on the task. The association between reflection and MIL was curvilinear, such that MIL was strongly negatively related to CRT performance particularly at low levels of MIL. In Study 5 ($N = 804$), intuitive or reflective mindsets were induced and FI and MIL were measured. Induced processing style study did not affect MIL. However, those high in MIL were more responsive to the intuitive mindset induction. The relationship between FI and MIL was curvilinear (in this and the correlational studies), with intuitive processing being strongly positively related to MIL particularly at higher levels of MIL. Although often considered in the context of conscious reflection, MIL shares a positive relationship with reliance on gut feelings, and high MIL may facilitate reliance on those feelings.

Meaning in Life and Intuition

Evidence of the human capacity to create meaning surrounds us. We use language to tell stories that make sense of experience (Pennebaker & Seagall, 1999) and serve as a source of identity (e.g., Adler, 2012; McAdams, 1993; McAdams & McLean, 2013). We create grand narratives, religions (Park, Edmundson & Hale-Smith, 2013), philosophies of life, and worldviews that provide a framework of values (Koltko-Rivera, 2004), and invest in goals that give life a sense of purpose (Emmons, 1999). We create and participate in cultures providing opportunities to matter to the world in a lasting way (Becker, 1971). Even psychological approaches to meaning that emphasize its automatic nature nevertheless describe meaning as something human beings "construct and impose on the world" (Heine, Proulx & Vohs, 2006, p. 90). It's not surprising, then, that human beings have often been described as natural meaning-makers. Yet, because humans can and do create meaning does not imply that all (or even most) of the meaning people experience in their lives is necessarily a product of active construction. In this article, we test a perspective that links the experience of meaning in life (MIL) not to active construction, but to automatic, effortless, *intuitive* information processing.

MIL may be defined as the extent to which a person experiences his or her life as having purpose, significance, and coherence (Baumeister, 1991; King, Hicks, Krull, & Del Gaiso, 2006; Steger, 2012). This last aspect of meaning emphasizes that a meaningful life is one that makes sense to the person living it (Baumeister & Vohs, 2002). Certainly, understanding the ways that people "make sense" of experience is an abiding concern of psychologists (James, 1890). Information processing (i.e., "making sense") has been characterized in terms of the degree to which it is automatic/intuitive or effortful/reflective, whether these characteristics are viewed as emerging from two independent systems (e.g., Evans, 2002, 2010; Evans & Stanovich, 2013; Strack & Deutsch, 2004; Thompson et al., 2013) or one (e.g., Keren & Schul, 2009; Kruglanski, 2013; Kruglanski & Grigerenzer, 2011). Setting aside the question of whether these processing styles reflect qualitatively different systems or different ends of a continuum, in the present studies we examined how relatively more or less intuitive processing, as an individual difference (Studies 1-3) or induced processing style (Studies 4 and 5), related to the

experience of MIL. We predicted that MIL and reliance on intuition would share a positive correlational relationship. Further, we predicted that high levels of MIL would facilitate reliance on intuitive processing.

The association between MIL and reliance on intuitive information processing has received scant scholarly attention. The few studies that have examined the relationship between self-reported MIL and the Faith in Intuition scale (FI, Pacini & Epstein, 1999) have reported weak but positive correlations (King & Hicks, 2009a; Norris & Epstein, 2011; Pacini & Epstein, 1999). However, in none of this work was the association tested against a host of potential third variables. Moreover, finding a positive association does not tell us why these variables are positively related. To generate predictions in this regard, we turn to a new perspective on the experience of meaning.

(Feelings of) Meaning-as-Information and Cognitive Processing

Drawing on the feelings-as-information approach to mood and cognition (e.g., Clore & Palmer, 2009; Schwarz, 2012; Schwarz & Clore, 1988), Heintzelman and King (2014a) proposed a meaning-as information framework. They argued that the feeling of meaning is one of the "gut feelings" that occupy what William James (1890) described as the nonsensory fringe of the stream of consciousness or what contemporary scholars call meta-cognitive experience. These fringe feeling states have been shown to play a central role in intuitive information processing (e.g., Topolinski & Strack, 2009a, b). A key aspect of the fringe of consciousness is what James termed the "subjective rationality" or the "feeling of right direction." This feeling of rightness (e.g., Thompson et al., 2013; sometimes referred to as the *feeling of meaning*, Hicks, Cicero, Trent, Burton, & King, 2010; Mangan, 2000, 2001) emerges around sensory experiences, providing information about the degree to which subjective experience is making sense.

Linking this feeling of meaning to the automatic processes of associative learning and the perception of covariation (Turk-Browne, Scholl, Chun, & Johnson, 2008; Zhao, Al-Aidroos, & Turk-Browne, 2013), Heintzelman and King (2014a) posited that, to the extent that the world itself is characterized by reliable associations (as it must be for the capacity for associative learning to be adaptive, Domjan 2005), reality is not essentially chaotic. From this perspective, although the experience

of meaning can be constructed, more often than not the meaning humans experience emerges out of interactions with a world that very often makes sense (Heintzelman & King, 2014a, 2013; King, 2012). Importantly, extracting reliable associations in the environment is considered a key function of intuitive information processing (Evans, 2002; Geary, 2004).

Research supporting the idea that the experience of meaning tracks systematic associations in the environment shows that MIL is higher after exposure to stimuli that are characterized by pattern or coherence compared to stimuli that are random or incoherent (Heintzelman, Trent, & King, 2013). For example, in one study, participants were asked to view and make ratings about the appearance of a series of photographs of trees. The 16 pictures included four depicting each of the four seasons. The order in which the pictures were shown was systematically varied. In one group, the 16 pictures appeared in a random order. In another, they were arranged so that they followed the change in seasons, over four cycles (conforming to Spring, Summer, Fall, and Winter). After completing the picture ratings, all participants rated MIL. MIL was significantly higher in the seasonal pattern group than in the random group (Heintzelman et al., 2013, Study 1). In a subsequent study, MIL was higher after exposure to the same pictures presented in a novel pattern (vs. a random order; Study 2). Similar results were found for exposure to coherent linguistic word triads (those that shared a fourth common associate) vs. the same words arranged in incoherent triads. Those participants exposed to coherent semantic triads rated their lives as more meaningful compared to controls (Heintzelman et al., 2013, Study 4).

These studies demonstrate that MIL is high when experiences make sense (and lower when experiences do not). The meaning-as-information approach asserts, further, that these feelings of meaning provide information that guides cognitive processing: When MIL is high, intuitive processes are likely to predominate, when MIL is low, reflection is likely to be brought to bear.

The meaning-as-information approach fits well with previous conceptualizations of the likely relationships of styles of information processing to the experience of meaning in traumatic life experiences. Even as they focus on the construction of meaning in the aftermath of trauma, these perspectives suggest that meaning may not be *inherently* reliant on constructive efforts. Rather, reflection

is likely to be employed when meaning is felt to be lacking. For instance, in the meaning-making model, Park (2010; see also Park & Edmondson, 2012) suggested that the experience of meaning is maintained via sources of global meaning (e.g., beliefs, goals, and purposes) that confer meaning upon specific life events and inform appraisals of those events. The experience of meaning is regulated via a comparison between current experience and one's global and situational meaning systems. This self-regulatory system can be perturbed by the occurrence of trauma, and if these traumatic events evoke a discrepancy within one's meaning systems, this can spur the active creation of meaning. Similarly, Janoff-Bulman and Yopyk (2004) posited that prior to a trauma, a person was likely on "automatic pilot," that is, relying on intuitive processing (Janoff-Bulman & Yopyk, 2004). However, following a traumatic event, effortful processing may be crucial to making or reinstating meaning. Although emphasizing the role of effortful processing following trauma, these perspectives suggest that when life is felt to be meaningful, a person may be likely to rely on intuitive processing. As predicted by the meaning-as-information approach, when meaning is felt to be high, it makes sense to rely on intuition.

Overview and Predictions

The present studies examined the relationship between MIL and intuitive information processing. Studies 1 through 3 were cross-sectional studies testing the correlation between MIL and self-reported reliance on intuition. Across the studies, we predicted that MIL would be associated positively with Faith in Intuition and that this relationship would maintain when controlling for a variety of covariates, the rationales for which we describe prior to the studies in which they were measured. Of course, evidence supporting our predictions from Studies 1-3 cannot answer the question, "Does intuitive information processing influence MIL or does MIL influence intuitive processing?" Studies 4 and 5 were experiments that sought to answer this question, addressing the potential causal links between MIL and reliance on intuition.

Study 1

Study 1 was an exploratory investigation using a relatively large sample but with rather limited measures of the constructs of interest. This study was not designed to test our central predictions. Rather

this pre-existing dataset represented an opportunity to examine whether MIL might relate to FI, and whether this relationship might be explained by positive affect (PA) or religious beliefs.

PA is positively related to MIL (e.g., King et al., 2006). In addition, PA has often been associated with a tendency to engage in heuristic (i.e., intuitive) processing (e.g., Bodenhausen, Kramer, & Süsser, 1994; though see Huntsinger, Clore, & Bar-Anan, 2010; Huntsinger, Sinclair, Dunn, & Clore, 2010). Moreover, a review of the characteristics of the intuitive processing system and the effects of PA on cognitive processing suggests a great deal of overlap (Burton, Heintzelman, & King, 2013). In this sense, PA may underlie an association between MIL and FI.

Likewise, religious faith is often considered a fundamental source of the experience of MIL (Park et al., 2013). Religious individuals report higher MIL than the nonreligious, and MIL has been shown to mediate the relationship between religiosity and psychological well-being more generally (Steger & Frazier, 2005). Religiosity also shares a relationship with intuitive processing. Religious (as well as paranormal) believers are characterized by a pattern of lower analytical thinking and higher reliance on intuition (Aarnio & Lindeman, 2007). Furthermore, an experimental induction of intuitive mindset led to higher God beliefs (Shenhav, Rand, & Greene, 2012). In addition, performance on the Cognitive Reflection Task (CRT; Frederick, 2005), a measure of the tendency (and ability) to override heuristic processing via effortful reflection, is negatively associated with religious belief (Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012; see also Zuckerman, Silberman, & Hall, 2013) and heuristic answers on this measure relate positively to belief in God (Shenhav et al., 2012). Clearly, then, it is important to examine a potential influence of religious faith on the relationship between FI and MIL. We predicted that MIL would be associated with FI, controlling for PA and religiosity.

Method

Participants and Procedures

Participants were 3,131 (1,826 women, 1,304 men, 1 transgender; 81.1% White/European American, 10.5% Black/African American, 4.6% Asian or Asian American, 3.3% Latino/a, 1.5% Native American, 1.5% other) undergraduates who completed an online assessment as a part of a mass survey of

students in General Psychology at the University of Missouri over two semesters. Mean age was 18.67 (*SD* = 1.46).

Measures

Participants completed the 5 item FI subscale from the Rational Experiential Inventory (REI; Pacini & Epstein, 1999). Sample items include, "I believe in trusting my hunches," and "I often go by my instincts when deciding on a course of action." Items were rated on a scale from 1 (*not at all*) to 7 (*very much*), *M*(*SD*) = 5.01 (0.94), α = .82.

To measure MIL, the participants rated a single item from the Meaning in Life Questionnaire Presence of Meaning Subscale (MLQ-P, Steger, Frazier, Oishi, & Kaler, 2006), "My life has a clear sense of purpose," on a scale from 1 (*not at all true*) to 7 (*absolutely true*), *M*(*SD*) = 4.91 (1.38). Participants also completed a single item rating of the importance of their identification with their religious group on a scale from 1 (*not at all important*) to 5 (*extremely important*), *M*(*SD*) = 3.29 (1.35). Finally, a subset of participants (*n* = 1,135) completed ratings of PA, indicating the degree to which they felt each of the following: happy, cheerful, pleased and enjoyment/fun on a scale from 1 (*not at all*) to 7 (*very much*), *M*(*SD*) = 4.70 (1.26), α = .89.

Results

As predicted, the single item measure of MIL was positively correlated with FI, $r = .21$, $p < .001$, bootstrapped with 1000 resamplings, 95% Confidence Interval (CI) = [.168, .246]. The importance of religious identification item was positively related to both MIL, $r = .16$, and FI, $r = .05$, both *p's* < .001. When MIL was regressed on these variables simultaneously, both FI (β = .20) and importance of religious identification (β = .16) contributed significantly (*p*'s < .001), Multiple $R^2 = .07$; $F(2,3106) = 112.73$, $p < .001$. Among participants who completed the measure of PA, the positive correlation between MIL and FI was significant, $r = .20$, $p < .001$. PA was correlated with FI ($r = .25$) and MIL ($r = .36$, both *p*'s < .001). In a regression equation, PA (β = .33) and FI (β = .12), independently predicted MIL (both *p*'s < .001), Multiple $R^2 = .14$; $F(2,1132) = 94.17$, $p < .001$. (Additional analyses for this study and subsequent studies can be found in the supplementary materials.)

Study 1 provides initial evidence supporting the prediction that FI and MIL would be positively related. An important limitation of Study 1 is the use of a single-item rating of MIL. In addition, this study was admittedly exploratory and included only measures of PA and (an admittedly limited measure of) religiosity as potential "third variables" in this relationship. To buttress these initial findings, we conducted Study 2, which included full measures of MIL and religiosity.

Study 2

Study 2 participants completed measures of FI and MIL, as well as a measure of intrinsic religiosity. Again, we predicted that FI would be associated with MIL while controlling for religiosity, and furthermore, that religiosity would not fully mediate this relationship.

Method

Participants and Procedures

Participants were 922 (553 women, 364 men, 2 transgender, 3 not reporting gender) undergraduates who completed an online mass survey for General Psychology at the University of Missouri. In a format allowing selection of multiple categories, participants reported their race/ethnicity: 82.2% white/Caucasian, 11.3% Black/African American, 6% Asian, 3.7% Hispanic/Latino, 1.5% Native American, and 11% "other." Age ranged from 18 to 36, *M(SD)* = 18.95 (1.32). Among those endorsing a religious affiliation (n = 804), a majority described themselves as Catholic, Christian, or Protestant (n = 664).

Measures

Participants completed the same 5-item measure of FI used in Study 1, *M(SD)* = 5.06 (1.03), α = .87. MIL, in this study, was assessed with the full five-item MLQ-P (Steger et al., 2006), *M(SD)* = 5.17 (1.26), α = .92. An additional example item from this scale is, "I have a good sense of what makes my life meaningful."

Lastly, participants completed five items measuring intrinsic religiosity (Gorsuch & McPherson, 1989). These items were: "I try hard to live all my life according to my religious beliefs," "My whole approach to life is based on my religion," "It is important to me to spend time in private thought and

prayer," "I enjoy reading about my religion," and "I have often had a strong sense of God's presence," *M(SD)* = 4.00 (1.73), α = .93.

Results

FI was positively associated with MIL, r = .23, p < .001, bootstrapped 95% CI = [.161, .295]. FI shared a small but statistically significant relationship with intrinsic religiosity (r = .09, p = .008). MIL was significantly associated with intrinsic religiosity (r = .35, p < .001). To examine whether the association between FI and MIL could be attributed to religiosity, we regressed MIL on FI and intrinsic religiosity simultaneously. Both FI (β = .20) and intrinsic religiosity (β = .33) independently predicted MIL (p's < .001). Finally, we tested whether intrinsic religiosity mediated the relationship between FI and MIL. A mediational analysis (Hayes, 2009; Preacher & Hayes, 2005) revealed a significant indirect effect of FI on MIL through intrinsic religiosity, z = 2.59, p = .01; 95% CI bootstrapped with 3000 re-samplings for the indirect effect = [.008, .065]. The direct path from FI to MIL, however, remained significant controlling for intrinsic religiosity, B = 0.25 (0.04), p < .001, suggesting only partial mediation.

Brief Discussion of Studies 1 and 2

Studies 1 and 2 support the prediction that MIL is associated with FI, an association that predicted unique variance beyond PA and religiosity. Study 2 showed that this relationship was only partially mediated by intrinsic religiosity. Still, the covariates included in these first two studies were limited. Although PA and religiosity are strong predictors of MIL, additional variables sharing relationships with both FI and MIL might explain their relationship with each other. To pay due diligence to the potential for third variable explanations for this association, Study 3 cast a wider net of possible covariates.

Study 3

In addition to PA and religiosity, Study 3 included two other potential third variables, self-esteem and basic psychological need satisfaction. Past research shows a consistent positive relationship between FI and self-esteem (Epstein, Pacini, Denes-Raj, & Heier, 1996; Jordan, Whitfield, & Zeigler, 2007; Norris

& Epstein, 2011). Self-esteem is also a robust predictor of psychological well-being (Ford & Collins, 2013; Pyszczynski, Greenberg, Solomon, Arndt, & Schimel, 2004) and plays a role in existential meaning (Routledge et al., 2010). As such, an analysis of the relationship between FI and MIL should consider whether this relationship is explained by self-esteem.

Basic psychological need satisfaction refers to the extent to which needs for social relatedness, autonomy, and competence, proposed to be the central needs underlying intrinsic motivation (e.g., Ryan & Deci, 2001), are fulfilled in a person's life. Past research shows that basic need satisfaction is associated with MIL (Trent & King, 2010). Although the association between intrinsic motivation and FI has not been specifically tested, it makes conceptual sense that reliance on intuitive impressions might be related to the satisfaction of organismic needs. Humanistic approaches to psychological functioning describe optimal functioning as involving an openness to one's genuine feelings and propose that humans possess an innate experience valuing process (Rogers, 1961; Sheldon, Arndt, & Houser-Marko, 2003). Listening to these organismic signals is conceptually similar to attending to one's gut feelings (Burton, 2008). In addition, Epstein (1998) argued that behavior driven by the intuitive system is likely to feel intrinsically rewarding. Thus, Study 3 participants also completed a measure of basic need satisfaction in order to control for this contributor to a sense of meaning.

Finally, Study 3 included a measure of need for cognition (NC). NC concerns enjoying thinking and tackling complex intellectual problems. NC involves intrinsic motivation for cognitive activity (Cacioppo, Petty, Feinstein, & Jarvis, 1996) and past research has found a positive association between NC and MIL (Pacini & Epstein, 1999). Including this scale in Study 3 allowed us to examine if FI related to MIL controlling for NC.

Method

Participants and Procedures

Participants were 1,026 (563 women, 459 men, 1 transgender, 3 not reporting gender; 80.8% White/European American, 8.1% Black/African American, 4.5% Asian/Asian American, 2.4% Latino/a, 1.1% Native American, 2% other race/ethnicity) undergraduates who completed measures as part of a

mass online survey in General Psychology at the University of Missouri. Mean age was 19.08 (*SD* = 1.67). Among those who endorsed a religious affiliation (*n* = 883), most (*n* = 817) described themselves as Catholic, Christian, or Protestant.

Measures

The measure of FI was the same as in Studies 1 and 2 and the full 5-item MLQ-P (Steger et al., 2006) from Study 2 was used.[1] Two items measured religiosity. Participants completed a single item rating of the importance of their identification with their religious group on a scale from 1 (*not at all important*) to 5 (*extremely important*), and a second item, "I am a religious person" on a scale from 1 (*not at all*) to 7 (*very much*). These items correlated ($r = .65$, $p < .001$), so we standardized and averaged them to form a single religiosity measure. All other items were rated on a scale from 1 (*not at all/absolutely not true*) to 7 (*very much/absolutely true*) scales. To measure PA, participants rated how much they were feeling happy, pleased, cheerful, and joyful. Participants rated five NC items drawn from the REI Need for Cognition subscale, including "I prefer complex to simple problems," and "I try to avoid situations that require a lot of thinking" (reverse scored).

To assess self-esteem, participants completed the 10-item Rosenberg Self Esteem Scale (Rosenberg, 1965). This scale includes items such as "I take a positive attitude toward myself." Due to an error in programming, the self-esteem measure was completed by only a subset of the total sample (*n* = 1,008).

Participants also completed the Balanced Measure of Psychological Needs Scale (Sheldon & Hilpert, 2012) as a measure of basic need satisfaction. Items refer to three organismic needs: competence, autonomy and relatedness. Each need is represented by six items: three referring to need satisfying experiences, and three referring to need dissatisfying experiences. Sample items include " I was free to do things my own way," (autonomy, satisfying); "There were people telling me what I had to do," (autonomy, dissatisfying); "I took on and mastered hard challenges," (competence, satisfying); "I struggled doing something I should be good at," (competence, dissatisfying); "I felt a strong sense of intimacy with people," (relatedness, satisfying); and "I felt unappreciated by one or more important

people," (relatedness, dissatisfying). We averaged the satisfying and dissatisfying items across needs to create overall need satisfaction and need dissatisfaction measures (see Sheldon & Hilpert, 2012).

Results

Table 1 shows the reliabilities, descriptive statistics and correlations for Study 3 measures. Again, FI and MIL were significantly, positively correlated, bootstrapped 95% CI = [.243, .371]. NC was positively correlated with both FI and MIL. FI was also related to a number of variables that were, in turn, related to MIL, suggesting that these variables might explain that relationship. The final column of Table 1 shows the partial correlations of FI and MIL controlling for each of the other variables. All remained significant. In addition, NC remained positively correlated with MIL while controlling for FI, partial $r = .19$, $p < .001$.

In additional analyses testing the independent association between FI and MIL, we conducted a series of regression equations and mediational analyses. Results showed mutual *partial* mediation for all predictors, yet none of the covariates fully explained the association between FI and MIL (full results can be found in the Supplementary Materials). Finally, we regressed MIL on FI with all other predictors simultaneously. Controlling for these covariates (all remained significant predictors of MIL, β's ranged from .08 for need satisfaction, $p = .01$, to .20 for PA, $p < .001$), FI continued to share unique variance with MIL, $\beta = .15$, $p < .001$, Multiple $R^2 = .30$, $F(6,993) = 69.19$, $p < .001$.

Brief Discussion of Study 3

Study 3 provides additional evidence of a positive relationship between FI and MIL, controlling for additional possible third variables. That the relationship between FI and MIL obtained while controlling for self-esteem and need satisfaction is particularly compelling because it shows that the link between FI and MIL is not simply the result of individuals who are prone to Pollyanna-like thinking (Pacini & Epstein, 1999) saying mindlessly nice things about themselves. Rather, controlling for these desirable variables, FI related to MIL.

Summary of Studies 1-3

Though limited by their cross-sectional correlational designs, the first three studies are notable because they demonstrate an association with implications for the meaning of MIL. The sample-size weighted correlation between MIL and FI across these three studies, r = .23, 95% CI = [.217, .243], indicates just over 5% shared variance in MIL and FI (a figure that is in keeping with typical effect sizes reported in social psychology, r = .21, Richard, Bond, & Stokes-Zoota, 2003). MIL is a predictor of psychological functioning, (e.g., Mascaro & Rosen, 2005; Owens, Steger, Whitesell, & Herrerra, 2009; Steger & Kashdan, 2009), cognitive functioning (Boyle, Buchman, Barnes, & Bennett, 2010), social appeal (Stillman, Lambert, Fincham, & Baumeister, 2011), occupational adjustment (Littman-Ovadia & Steger, 2010), physical health (Steger, Mann, Michels, & Cooper, 2009), disease risk (Kim, Sun, Park, & Peterson, 2016; Kim, Sun, Park, Kubzansky, & Peterson, 2013), and mortality (Boyle, Barnes, Buchman, & Bennett, 2009; Krause, 2009). As such, documenting its associations with individual differences is important. Further, the association between MIL and FI suggests that rather than always emerging as a product of active construction, MIL is associated, positively, with reliance on automatic pilot.

Exploring Causation

The first three studies demonstrate a replicable association between FI and MIL. It may be that reliance on intuitive processing allows those high in FI to attend to the feelings that the extraction of reliable associations in the environment inspires and to therefore, enjoy higher levels of MIL. Alternatively, it might be that feeling that one's life is meaningful leads to reliance on intuitive information processing, as is suggested by the meaning-as-information model. We next adopted experimental designs to probe these possibilities.

Studies 4 and 5 manipulated information processing strategies in order to examine potential effects on MIL. In addition, the designs of Studies 4 and 5 allowed us to test whether MIL would moderate the effects of manipulations on subsequent information processing. Such moderation would provide evidence that MIL serves to *direct or facilitate* intuitive information processing. Specifically, we predicted that high levels of MIL would facilitate intuitive processing and lead to heightened

susceptibility to an intuitive mindset. In contrast, at low levels of MIL, individuals would be less likely to engage in intuitive processing and more likely to engage in reflective processing.

Study 4

Study 4 further examined the association between MIL and intuitive processing using the Cognitive Reflection Task (CRT, Frederick, 2005) as an induction of reflective (or low intuitive) mindset (Paxton, Ungar, & Greene, 2012). Previous work demonstrated that completing the CRT affects the mindset utilized on subsequent tasks (e.g., moral reasoning, Paxton et al., 2012), supporting its use as an effective manipulation for our purposes. In the present study, approximately half of the participants were assigned randomly to complete the CRT just prior to rating MIL (reflective/low intuitive mindset condition); the rest completed the CRT just after rating MIL (control condition). If intuition facilitates the experience of meaning, then we would expect that those in the experimental condition would report lower MIL than controls (similar to results for God belief, Shenhav et al., 2012).

Furthermore, the inclusion of an order manipulation allowed us to also examine whether the association between MIL and information processing was moderated by order. If intuitive processing facilitates meaning, we would expect heuristic answers on the CRT to be positively correlated with subsequent MIL. However, if, as we have proposed, MIL serves to direct information processing then we would expect that, among those who completed the MIL measure first, levels of MIL would predict CRT outcomes. Specifically, MIL would be negatively related to correct answers and time spent on the CRT and positively associated with heuristic answers. This set of results would support the idea that feelings of meaning guide information processing style.

Study 4 expanded on the previous studies in additional ways, as well. First, Study 4 employed a non-college adult sample. Second, in addition to FI, CRT, religiosity, PA, and MIL, Study 4 included a measure of negative affect (NA) and a brief measure of the Big Five personality traits. Extraversion, in particular, has been shown to relate positively to MIL (King et al., 2006). FI has been shown to correlate with extraversion as well as agreeableness, and conscientiousness (Pacini & Epstein, 1999). As such, in

continued efforts to test potential third variable explanations for this effect, it is important to show that the association of FI and MIL remains controlling for these variables.

Method

Participants

614 Amazon Mechanical Turk workers (*M* age = 33.47, *SD* = 12.31; 286 women, 321 men, 7 not reporting gender; 78.7% White/European American, 8.2% Black/African American, 5.6% Latino/a, 5.8% Asian American, 1.6% other race/ethnicity; paid $0.50) completed a set of online measures.

Measures

The ratings for all measures were made on scales from 1 to 7. Reliabilities and descriptive statistics for the questionnaire measures are shown in Table 4. MIL, NC, and PA were assessed as in Study 3. Negative mood was measured by having participants rate the extent to which they were experiencing a series of negative mood states: angry, frustrated, nervous, anxious, worried, and sad. FI was measured using the 13-item FI measure from the REI (Pacini & Epstein, 1999). Unlike the shorter version used in Studies 1-3, this version contains some reverse coded items, for instance, "I think it is foolish to make important decisions based on feelings."

Religiosity. Participants completed two measures of religiosity. First, they completed the Religious Commitment Inventory-10 (RCI-10; Worthington et al., 2003), a 10-item scale that assesses religious commitment. Sample items include "I spend time trying to grow by understanding my faith," and "It is important for me to spend periods of time in private religious thought and reflection" (α = .97). They also completed a measure of intrinsic and extrinsic religiosity (Gorsuch & McPherson, 1989). Eight items measured intrinsic religiosity (e.g., "I have often had a strong sense of God's presence," and "It is important to me to spend time in private thought and prayer;" α = .82). Two 3-item subscales measured personal extrinsic and social extrinsic religiosity. A sample item for personal extrinsic religiosity is, "I pray mainly to gain relief and protection" (α = .86). A sample item for social extrinsic religiosity is, "I go to church mostly to spend time with my friends" (α =.87).

In order to simplify analyses, and because we were interested in religiosity as a covariate (not the difference between types of religiosity and MIL), we examined the associations of each religiosity measure with MIL. Religious commitment (r = .39) and intrinsic religiosity (r = .31, both p's < .001) were significantly correlated with MIL. Personal extrinsic religiosity was related to MIL (r = .20, p < .001) but less strongly. Social extrinsic religiosity was not related to MIL (r = .05, p = .33). Religious commitment, intrinsic religiosity, and personal extrinsic religiosity were correlated with each other, as well (r's ranging from .84 to .53). In order to pit FI against the most relevant measure of religious faith, we created a composite that included only the religious commitment and intrinsic religiosity measures.

Big Five Personality Traits. To measure the Big Five personality traits, participants completed the Ten Item Personality Inventory (Gosling, Rentfrow, & Swann, 2003) which includes two items for each trait, including emotional stability, extraversion, openness to experience, agreeableness, and conscientiousness. This brief measure has shown convergent validity with longer measures of these traits (Gosling et al., 2003).

Cognitive Reflection Task. The CRT (Frederick, 2005) is a measure designed to gauge system 2 override of heuristic impulses. It includes three questions, each featuring a compelling but incorrect heuristic answer. An example problem is, "A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?" The compelling heuristic answer is 10 cents, however, the correct answer is 5 cents. This measure has been used in a variety of studies in diverse ways, as a measure of reflection (Shenhav et al., 2012), cognitive ability (Zuckerman et al., 2013), and as a manipulation of reflective mindset (Paxton et al., 2012). CRT performance reflects a particular cognitive style that is a potent predictor of avoidance of heuristics and biases, even controlling for measures of general intelligence (Toplak, West, & Stanovich, 2011).

The CRT can be scored either by tallying correct answers or heuristic answers. Neither type of score was normally distributed. The distribution of total correct answers was: 0 (n = 249), 1 (n = 113), 2 (n = 100) and 3 (n = 147), M(SD) = 1.24 (1.22), α = .77. The distribution for heuristic answers was: 0 (n = 177), 1 (n = 124), 2 (n = 154), and 3 (n = 159), M(SD) = 1.48 (1.16), α = .68. These variables were

strongly negatively related, $r = -.89$, $p < .001$. Correct and heuristic answers are not perfectly negatively related because some responses were wrong but not heuristic in nature.

The tally of correct answers on the CRT gauges (successful) effortful reflection, however, some individuals may devote careful thought to this task and nevertheless fail to produce the correct answer (particularly if they lack the skill to accurately solve the problems, Thompson et al., 2013). To fully encompass reflective engagement, the seconds spent on the CRT were recorded, averaged over the items, $M(SD) = 23.9$ (36), $\alpha = .45$. Time was not related to correct ($r = .05$, $p = .21$) or heuristic answers ($r = -.06$, $p = .19$).

Procedure

All participants first completed measures of FI, NC, mood, personality traits, and religiosity (in that order). A subset ($n = 330$) was then assigned randomly to the reflective mindset condition and completed the CRT immediately followed by MLQ-P; the others ($n = 284$) served as the control condition and completed the MLQ-P immediately followed by the CRT.

Results and Discussion

Did the manipulation affect meaning in life?

First, we tested the effect of mindset condition on MIL to test whether a reflective mindset influenced MIL. It did not: $M(SD)$'s for the reflective mindset condition (i.e., CRT first) = 4.44 (1.59), for controls (i.e., MIL first), 4.36 (1.59), $t(609) = 0.55$, $p = .58$, $d = 0.05$. The Jeffrey-Zellner-Siow (JZS) Prior Bayes factor (Rouder, Speckman, Sun, Morey, & Iverson, 2009) indicates that the null is 13.42 times more likely than the alternative. Thus, this study provides no evidence that manipulated cognitive processing style influenced MIL. Additionally, the manipulation did not affect any of the CRT variables (correct answers, heuristic answer, or time spent on the task).

Were CRT outcomes correlated with meaning in life?

Collapsing across conditions, MIL shared modest correlations with CRT correct, $r = -.15$, $p < .001$, and heuristic responses, $r = .12$, $p = .002$, in the predicted directions. MIL was unrelated to time spent on the CRT, $r = -.06$, $p = .15$. Given the distribution of CRT scores, we examined this variable with

special concern for the possibility that it might not be best treated as normally distributed interval level data. We divided participants into four groups (reflecting CRT scores of 0 to 3; see Shenhav et al., 2012). A 2 (condition) X 4 (CRT score) analysis of variance (ANOVA) on MIL scores showed only a main effect of CRT scores, $F(3,601) = 5.31$, $p = .001$; for condition, $F(1,601) = 0.23$, $p = .65$; for the interaction, $F(3,601) = 0.58$, $p = .63$. A similar analysis of MIL for heuristic answers (ranging from 0 to 3) showed a main effect of heuristic answers, $F(3,603) = 3.70$, $p = .012$, no effect of condition, $F(1,603) = 0.29$, $p = .59$, and no interaction, $F(3,601) = 0.55$, $p = .65$. The means for MIL across CRT correct and heuristic answers are shown in Table 2. As can be seen, MIL scores were lowest for the perfect scorers, whose MIL was significantly lower than those scoring either 0 or 1. Similarly, for heuristic answers, those scoring 0 were significantly lower than those scoring 3. These patterns suggest curvilinear relationships that might be missed focusing on the modest linear correlations.

Thus, we next regressed CRT performance on (centered) MIL, as well as its quadratic (MIL^2). Results showed that a linear relationship between MIL and CRT performance, $\Delta R^2 = .02$; $\beta = -.13$, $p = .002$, was qualified by the quadratic term, $\Delta R^2 = .01$; $\beta = .10$, $p = .014$. For the equation, $R^2 = .033$, $F(2,606) = 10.26$, $p < .001$. The curve generated for this relationship (collapsing across orders) is shown in Figure 1. CRT scores were highest at the lowest levels of MIL, with the line sloping downward as MIL increased and eventually becoming flat at moderate levels of MIL. Regressing heuristic responses produced similar results in the opposite direction, for MIL, $\beta = .10$, for MIL^2, $\beta = -.10$, *p's* < .02; for the equation $R^2 = .03$, $F(2,608) = 7.64$, $p = .001$. Regressing time to complete the CRT on MIL and MIL^2 produced no significant effects.

Did condition moderate the relationship between MIL and processing?

We next examined whether condition moderated the relationship between MIL levels and CRT, including the curvilinear relationship identified above. A regression equation predicting CRT performance from MIL, condition (dummy coded, 0 = control; 1 = reflective mindset), the interaction of these, as well as MIL^2 and its interaction with condition showed that main effects of MIL ($\beta = -.13$, *p*

= .002) and MIL^2 (β = .19, p = .002) were qualified by condition X MIL^2 interaction that fell short of significance, ΔR^2 = .01, β = -.14, p = .052. For the equation, R^2 = .04, $F(6,603) = 5.0$, $p < .001$.

Because this condition X MIL^2 interaction might provide clues to the direction of the relationship between MIL and information processing, we probed it further, regressing CRT scores on MIL and MIL^2 within each condition. Among those in the reflective mindset condition (i.e., who completed the CRT first), no significant effects were found: For MIL, β = -.11, p = .07, for MIL^2, β = .04, p = .45, for the equation, $R^2 < .01$, $F(2,324) = 2.50$, p = .08. In contrast, among controls (who rated MIL first), MIL contributed significantly, ΔR^2 = .04; β = -.16, p = .009, as did MIL^2, ΔR^2 = .03; β = .17, p = .004, for the equation, R^2 = .07, $F(2,279) = 9.85$, $p < .001$. The top panel of Figure 2 shows the slopes generated for each group with points plotted at .5 *SD* units. As can be seen, for those who completed MIL first, low levels of MIL were associated with higher performance on the CRT. An analysis using heuristic responses as the criterion mirrored these results, for MIL, β = .14, p = .018, for MIL^2, β = -.18, p = .004, for the condition X MIL^2 interaction, MIL, β = .13, p = .087.

When time to complete the CRT was regressed on condition, β = .08, p = .16; MIL, β = -.11, p = .07; their interaction, β = .07, p = .25; MIL^2, β = .18, p = .007; and the condition X MIL^2 interaction, ΔR^2 = .011, β = -.19, p = .01, the condition X MIL^2 interaction was significant. For the equation, R^2 = .024, $F(5,599) = 2.46$, p = .023. The bottom panel of Figure 2 shows the slopes generated across levels of MIL. For the reflective mindset condition, neither MIL nor the quadratic effect contributed to the equation, p's > .30. For controls, the quadratic effect was significant, β = .13, p = .03. For the equation, R^2 = .03, $F(1,279) = 3.99$, p =.02. Those who had just rated MIL as low spent more time on the CRT items. The patterns in Figure 2 suggest that low MIL predicts lower levels of reliance on intuition.[2] Using only the data for those who completed the MIL measure prior to the CRT, Table 3 shows the results for equations predicting each CRT variable from MIL and MIL^2 controlling for mood measures (see the supplementary materials for further discussion of these analyses).

Additional Correlational Analyses

Prior to computing the correlations among the continuous measures, we first examined whether the manipulation moderated the associations between these variables and MIL. Condition did not influence the relationships of interest and so we collapsed across conditions and present descriptive statistics and correlations for Study 4 continuous variables in Table 4.[3] As can be seen, FI and MIL were once again correlated, 95% CI = [.106, .271]. MIL also related to all the covariates assessed.[4] As in Study 3, NC was positively associated with MIL (in contrast to the modest negative correlation for the CRT). Interestingly, FI was associated positively with all of the Big 5 traits except emotional stability (suggesting that neuroticism is unlikely to explain the association between FI and MIL). The final column of Table 4 shows the partial correlations between FI and MIL, controlling for each of these other variables. FI maintained a significant positive association with MIL, holding each of these variables constant. Only PA and agreeableness reduced the relationship considerably (though the partial correlations remained significant).[5] Additional mediational analyses showed that both PA and agreeableness *partially* mediated the relationship between FI and MIL (full results for these analyses can be found in the supplementary materials). Finally, controlling for all of the Big Five, simultaneously (β's ranged from .08 for openness to experience, $p < .05$ to .19 for extraversion, $p < .001$), FI continued to share small but unique variance with MIL, $\beta = .10$, $p < .001$.

Brief Discussion of Study 4

In this study, inducing a reflective mindset had no influence on subsequent MIL. Rather, results provide support for the notion that levels of MIL direct cognitive processing, specifically that low levels of MIL spur reduced reliance on intuition. With regard to the correlational data, Study 4 replicated the positive relationship between MIL and FI in a sample of adults. This relationship remained while controlling for religiosity, mood, personality traits, and need for cognition. Study 4 results fit with a motivational account of the human need for meaning. It may be that those who recognized their lives to be lacking in meaning sought to compensate by performing well on the CRT.

Note that MIL only mattered to CRT performance when the person had just been reminded of his or her level of MIL. It is notable that in Studies 1-3, FI was measured *prior* to MIL in every case, yet,

clearly, MIL and FI were significantly correlated in those studies. Thus, whether a reminder of one's (low) MIL is required for MIL to relate to information processing styles is ambiguous. In addition, a key weakness of Study 4 was that it did not include a manipulation of intuitive processing. To resolve these issues, Study 5 utilized an alternate manipulation of information processing and included both a reflective and an intuitive mindset condition. In addition, Study 5 used the FI scale both as a manipulation check and as a way to examine the association between intuitive processing and MIL following the manipulations.

Study 5

This study employed procedures used by Shenhav and colleagues (2012) to induce an intuitive or reflective mindset. The design was a 2 (processing mindset: intuitive vs. reflective) X 2 (order of completing the dependent measures: MIL first vs. FI first) between participant design.

As in Study 4, these data allowed us to test two types of predictions. First, if processing style influences MIL, we would expect a main effect of the mindset manipulation on MIL. Second, we were able to examine whether MIL moderated the effects of condition on processing style, indicated by the FI measure. In keeping with Study 4, we predicted that participants experiencing high levels of MIL would be particularly affected by the intuitive mindset induction, endorsing high levels of FI in that condition. Alternately, we expected those experiencing low levels of MIL to be less susceptible to the intuitive mindset induction and more prone to adopt a reflective mindset, endorsing low levels of FI in the reflective mindset condition. (Given that FI measured prior to MIL in the correlational studies was related to MIL, we did not expect order to play a role in these results.) In light of the results of Study 4, we also tested for a potential curvilinear relationship between FI and MIL. In this case, because FI measures the tendency to rely on intuitive impulses, we expected that the curve (if one existed) would mirror those found for CRT performance and time spent on the task.

Method

Participants

Participants were 804 Amazon Mechanical Turk workers (431 men, 372 women, 1 not reporting gender; paid $1.00) who completed the experiment online. Age ranged from 18 to 74, *M(SD)* = 32.63 (11.59). Participants also reported their ethnicity: 78% White/European American, 5.8% Black/African American, 4.9% Latino/a, 8.5% Asian American, 2.8% other race/ethnicity.

Materials and Procedures

First, participants were randomly assigned to one of four versions of instructions, representing the crossing of processing style (intuitive vs. reflective) by valence of the outcome (success vs. failure). Following procedures outlined by Shenhav and colleagues (2012, Study 3, p. 426), participants were instructed to "…write a paragraph (approximately 8–10 sentences) describing a time your *intuition/first instinct* led you in the *right direction* and resulted in a *good* outcome." Italicized portions were manipulated (so that half the participants were alternately instructed to write about a time when they used thoughtful reflection; and within each processing style, for half of the participants the outcome was negative). Intuitive mindset was operationalized as those recalling an intuitive success or a reflective failure; reflective processing was operationalized as recalling a reflective success or an intuitive failure (after Shenhav et al., 2012). Previous research showed this manipulation to affect God belief (Shenhav et al., 2012), suggesting that it promotes intuitive thought processes, rather than merely making one adopt the belief that one is an intuitive thinker. The survey forced participants to remain on the writing screen for at least 1 minute before they could move forward. Time spent on the writing portion of the study was recorded, *M*(*SD*) = 5.56 minutes (4.73). Median time spent on the task was 4.2 minutes. The mode occurred at just over 1 minute (the time required by the survey).[6]

After completing this writing task, participants rated MIL, *M*(*SD*) = 4.63(1.56), α = .94, and FI *M*(*SD*) = 5.01(1.21), α = .92, (in counterbalanced order) using the measures from Study 4.

Results and Discussion

First, the essays produced by participants were screened to ensure that these fit with the assigned instructions. Analyses from a team of readers showed that 42 of the essays did not comport with

instructions (5.3% of the sample). Data from these individuals were dropped from further analyses (cell *n*'s ranged from 157 to 206).

Did the mindset manipulation influence FI?

First, as a manipulation check, we examined whether the manipulations led to differences in FI. A 2 (mindset) X 2 (order) ANOVA on FI showed main effects of mindset $F(1,744) = 11.20$, $p = .001$, partial $\eta^2 = .02$, and order, $F(1,744) = 4.86$, $p = .028$, partial $\eta^2 = .006$, and no interaction, $F(1,744) = 0.51$, $p = .48$, partial $\eta^2 = .001$. For mindset, the intuitive condition led to higher FI, *M(SD)* = 5.15 (1.18) compared to the reflective condition, 4.87(1.24), $d = 0.23$. For order, those who completed the FI scale first described themselves as slightly more intuitive, *M(SD)* = 5.09 (1.21) vs. 4.93 (1.21), $d = 0.14$. Thus, the manipulation influenced levels of FI as expected. Although the mindset manipulation effect is rather small, it is notable because the FI scale is a measure of *dispositional* reliance on intuitive processing.

Did the mindset manipulation influence MIL?

As in Study 4 induced mindset did not influence MIL. A 2 (mindset: intuitive vs. reflective) X 2 (order: MIL first vs. FI first) ANOVA on MIL showed no main effect for mindset condition, $F(1,744) = 0.00$, $p = .99$, partial $\eta^2 = .000$, a significant main effect for order, $F(1,744) = 5.24$, $p = .022$, partial $\eta^2 = .007$, and no interaction, $F(1,744) = 0.84$, $p = .36$, partial $\eta^2 = .001$. For order, those who completed the MIL measure first rated their lives as more meaningful, *M(SD)* = 4.77 (1.56) than those who rated FI first, *M(SD)* = 4.50 (1.56), $d = 0.17$. Manipulated mindset had no effect on MIL. Evidence in favor of the null is shown in Table 5. The table presents the means for the groups, overall, for those who wrote for relatively long times during the manipulation, and, those who wrote for a long time *and* completed the measure of MIL immediately after writing. Results in the bottom row of Table 5 are for participants who could be described as receiving the "highest dose" of the manipulation. Even among these participants, there was no difference in MIL. An effective manipulation of processing styles that influenced reports of (dispositional) reliance on intuitive processing did not influence the experience of MIL.

Did FI relate to MIL?

Overall, FI and MIL were, once again, positively correlated, $r = .20$, $p < .001$, 95% CI = [.131, .273], whether MIL was before ($n = 360$), $r = .24$, $p < .001$, or after FI ($n = 388$), $r = .17$, $p < .001$. In light of Study 4 results, we tested whether the association between FI and MIL might be curvilinear. Regressing FI on MIL and MIL^2 showed that, as in Study 4, a significant linear relationship, $\beta = .23$, $p < .001$, was qualified by a significant quadratic term, $\beta = .10$, $p = .015$; For the equation, $R^2 = .05$, $F(2,750) = 17.19$, $p < .001$. Figure 3 shows the generated curve: High MIL was associated with the highest levels of FI. At lower levels of MIL, the relationship between MIL and FI appears to be flatter.

Did MIL moderate the effects of condition on FI?

To examine whether, as predicted, the effects of condition on FI would be moderated by MIL, we dummy coded mindset condition (reflective = 0; intuitive = 1) and order (0 = MIL first; 1 = FI first). FI was regressed on MIL, MIL^2 and the interactions of these with mindset condition and order, the order X mindset interaction, as well as the three-ways between conditions and each MIL variable. In these analyses, no effect of order emerged. Rather, a main effect of MIL ($\Delta R^2 = .06$, $p < .001$; $\beta = .21$, $p = .01$) was moderated by a mindset condition X MIL^2 interaction, ($\Delta R^2 = .01$, $p < .033$) $\beta = .25$, $p = .008$. For the equation, $R^2 = .08$, $F(11, 736) = 6.03$, $p < .001$.[7]

Decomposing this interaction within mindset condition showed that in the reflective condition, only the linear effect of MIL predicted FI, $\beta = .15$, $p = .008$, for MIL^2, $\beta = -.02$, $p = .73$; for the equation, $R^2 = .02$, F (2, 360) 4.53, $p = .011$. Within the intuitive mindset condition, a main effect of MIL, $\beta = .30$, $p < .001$, was qualified by MIL^2, $\beta = .19$, $p < .001$, for the equation, $R^2 = .09$, $F(2,386) = 18.55$, $p < .001$. Figure 4 shows the generated regression lines for the two conditions, predicting FI over levels of MIL. As can be seen, in the intuitive mindset condition, when MIL was relatively high, it was positively associated with FI.[8]

Brief discussion of Study 5

Using an alternate manipulation of cognitive mindset, Study 5 provides further evidence suggesting that processing styles do not influence MIL. Rather, results suggest that MIL may foster processing styles, with high levels of MIL facilitating intuitive processing and low levels facilitating

reflection. A limitation of this study is the absence of a control condition against which to compare the intuitive and reflective mindset conditions. Without this third condition, it remains possible that both conditions moved in the same direction (i.e., that both the intuitive and reflective manipulations boosted MIL). While we cannot rule this out completely, there are several reasons that this is unlikely to be the case. First, in Study 4, there were no condition differences on MIL between those in a reflective mindset and those in a control condition and so we, similarly, might not expect the reflective mindset condition in this study to differ from a control condition, if it had been present. Furthermore, the mean MIL ratings provided in each condition (4.62 and 4.64) are very close to the average mean MIL reports provided on this measure across 122 samples consisting of 27,635 participants (4.56) (Heintzelman & King, 2014b).

Revisiting the relationship between MIL and FI in Studies 1-3

Studies 4 and 5 showed curvilinear relationships between MIL and information processing, such that MIL predicted information processing styles particularly at its extreme ends. Because we had not expected (nor tested) such relationships in the correlational studies, we revisited the data from the correlational studies to see if this quadratic effect was present in those datasets, as well. For Study 1, in which MIL was measured using a single item, predicting FI from MIL and MIL^2 showed the linear relationship of MIL ($\beta = .22$, $p < .001$) and a marginal quadratic association, $\beta = .03$, $p = .10$. For the equation, $R^2 = .04$, $F(2,3114) = 70.51$, $p < .001$. For Study 2, predicting FI from MIL and MIL^2 showed that the linear effect of MIL ($\beta = .26$, $p < .001$) was qualified by a significant quadratic term, $\beta = .08$, $p = .026$. For the equation, $R^2 = .06$, $F(2,921) = 28.93$, $p < .001$. For Study 3, predicting FI from MIL and MIL^2 showed that the linear effect of MIL ($\beta = .31$, $p < .001$) was qualified by a significant quadratic effect, $\beta = .09$, $p = .002$. For the equation, $R^2 = .10$, $F(2,1021) = 58.33$, $p < .001$. Figure 5 shows the curves predicting FI from MIL^2 for these three datasets. As can be seen, these correlational data follow the pattern of MIL being associated with reliance on intuitive processing particularly when MIL is moderately high. While modest, these results are notable because although it may commonly inflate or deflate linear associations, shared method variance (i.e., completing measures at the same time and in the same format) is more likely to (only) deflate the size of curvilinear associations (Siemsen, Roth, &

Oliveira, 2010). Thus, across all studies, MIL and intuitive information processing were particularly linked at the right side of the distribution of MIL: When MIL was moderately high, it related to intuition.

General Discussion

Experiencing life as meaningful is a vital aspect of healthy human functioning that has often been portrayed as stemming from thoughtful reflection. Based on the idea that rather than emerging as a byproduct of cognitive processing MIL may direct processing in important ways, we examined the association between MIL and intuitive information processing. This program of studies leads to four conclusions. First, MIL is positively associated with reliance on intuitive processing (all studies). Second, the shape of the association between MIL and information processing is curvilinear, with low MIL being associated with effortful reflection (or very low intuition) and high MIL being associated with reliance on intuition. Third, results of two experiments provide no support for the hypothesis that style of information processing causally influences MIL. Finally, MIL moderates the effects of information processing manipulations in ways that fit with the curvilinear associations noted above: When MIL is low, reflection is more likely to occur; when MIL is high intuitive processes are likely to dominate. These results fit with a functional and informational approach to MIL.

The (Feeling of) Meaning-as-Information

The current findings provide some evidence supporting the contention that MIL might serve the function of directing information processing in ways conducive to one's immediate circumstances, as predicted by the meaning-as-information perspective (Heintzelman & King, 2014a). The present results, in addition, highlight a central challenge to fully testing this approach. The curvilinear patterns uncovered suggest that MIL is only likely to influence information processing when it is either rather high or rather low. Many manipulations that influence MIL are quite subtle, and it seems unlikely that these would produce the levels of MIL found to facilitate either reflection or intuition in the present studies. In addition, momentary manipulations may produce levels of MIL that differ sufficiently (quantitatively) and that are, potentially, *qualitatively* different from the MIL that individuals brought with them into the present studies.

The patterns revealed in the present studies are consistent with two conclusions about the potential causal arrow between information processing and MIL: First, it seems quite unlikely to run from information processing to MIL; second, it *might* run from MIL to information processing. However, in the absence of experimental manipulations of MIL influencing processing, the evidence is supportive but not conclusive for the latter causal direction. Future research might track participants through traumatic, meaning-threatening, or profoundly meaningful life experiences and examine how changes in MIL relate to changes in information processing.

MIL and Intuitive Information Processing

If we superimpose the results of Study 4 with those of the other studies in this package, an image emerges of the association between MIL and processing style, across the various levels of MIL (from low to high). At low levels of meaning, cognitive effort is engaged in order to reinstate meaning via construction (Study 4). We propose that this association represents a majority of extant theorizing and research regarding MIL, the "human meaning-maker." We suggest that the notion that meaning is inherently constructed has emerged because psychologists have been most interested in the experience of meaning when it is lacking (King & Hicks, 2009b): When MIL is low, people (including psychologists and philosophers) are likely to think about it a great deal (e.g., in the meaning-making literature, Park, 2010). This pairing of vivid moments of meaninglessness with vivid times of reflecting on meaning has produced a potentially illusory correlation—the sense that meaning is an experience that *typically comes from* human construction or reflection.

Moving further along on the continuum, when MIL is felt to be moderately to especially high, our findings suggest that intuition is likely to be engaged (Studies 1-3, 5). Interestingly, as informed by the consistent curvilinear relationships emerging in our data, there would appear to be times when MIL is, apparently, irrelevant to information processing. In all studies, the line predicting intuitive processing from MIL is flat in the center of MIL. Perhaps at such times, other factors (e.g., mood, situational demands) might be increasingly relevant for cognition.

Several interesting connections can be proffered by integrating the present results with theory regarding the functions of information processing and the definition of MIL. Specifically, intuition seems most relevant to the coherence aspect of MIL, the notion that a person's life is characterized by reliable connections and that experiences make sense (see for instance, Proulx, Heine, & Vohs, 2010; Randles, Proulx, & Heine, 2011). In contrast, it may be that effortful reflection, is more relevant to those aspects of meaning that are more motivational and existential in nature, including purpose (defined as engagement in goal-directed pursuits) and, perhaps especially, significance (defined as mattering to others, making an impact, or forming a legacy).

Certainly, scholars have long puzzled over the purposes of consciousness (e.g., Baumeister & Masicampo, 2010; Geary, 2004; Mercier & Sperber, 2011; Morsella & Bargh, 2010). In grappling with this issue, Nicholas Humphrey (2000; 2006) suggested the provocative possibility that consciousness is deeply intertwined with the need to feel significant. For Humphrey, (the potential illusion of) awareness imbues human life with a vital survival need, raising the self beyond the natural world, to something larger, more mysterious, and potentially better. Consciousness promotes the feeling of a metaphysical self that is not limited by space or time. In answer to the question, "Why does consciousness matter?" Humphrey (2006, p. 131, emphasis in the original) replied, "Consciousness matters because *it is its function to matter.*" Thus, we might note two different meaning-related functions of information processing styles. Intuitive processing is occupied with extracting reliable associations in the service of survival (Domjan, 2005); reflective processing is occupied with the challenge of personal significance.

Affect and Meaning as Information

Results of Study 4 suggest that MIL predicted information processing independently of affect, however these results would seem to be a rather weak test of the contributions of mood and MIL to information processing. First, it is important to note that the measurement of mood was not counterbalanced with the CRT and MIL. Recall that among those who completed the MIL measure prior to the CRT, PA and NA were unrelated to CRT outcomes. It is possible that the MIL measure acted as an attributional cue, wiping out the effects of mood accordingly. Unfortunately, this issue was not addressed

in Study 5, primarily because the data for that study were collected before this potential argument occurred to us. As such, future research might continue to examine how and when meaning and affect independently (or together) guide information processing. Theoretical considerations might help to tease apart the roles of affect and meaning in the direction of cognitive processes. While distress has been suggested to be the initiator of meaning-making processes, meaning violations are not consistently distressing (Park, 2010) which suggests that affect regulation is not the primary goal of meaning-making. Rather, we suggest that low feelings of *meaning* (rather than high levels of negative affect) spur meaning construction efforts (Heintzelman & King, 2014a).

Although meaning has often been characterized as springing from deep introspection, the present studies show that MIL is positively correlated with reliance on intuitive processing. Moreover, the present results are consistent with the possibility that, rather than emerging from cognitive processing, MIL functions to guide that processing: When MIL is low, reflection is more likely to be brought to bear. However, when life is experienced as meaningful, MIL is associated with following one's gut feelings.

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Portions of Studies 1-4 were presented in an address entitled "The Magical Bathwater and the Baby of Meaning" in the Happiness and Well-being Preconference, Laura Aknin and Sonja Lyubomirsky, Chairs, Society for Personality and Social Psychology Convention, 2014, Austin, TX. Additionally, portions of all studies were presented in a talk entitled "Mundane Contributors to Meaning in Life" as part of the symposium session, "The Meaning of Life: Empirically Assessing Self-Actualization, Well-being, and Satisfaction," Rebecca Neel and Jaimie Krems, Chairs, Society for Personality and Social Psychology Convention, 2015, Long Beach, CA.

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Footnotes

[1]In Study 2 and Study 3, the single MLQ-P item used in Study 1 had corrected item-total correlations of .86 and .83, respectively, lending a supportive context to Study 1 results.

[2]To insure these results were not driven by a small group of individuals, we identified the place where the curved lines in Figure 2 begin to bottom out, approximately -.5 *SD* from the mean on MIL, or, in raw scores, 3.61. To probe whether low MIL rated prior to completing the CRT predicted more accurate answers, less heuristic responding, and more time on the CRT, we split MIL into a low group (MIL ≤ 3.61, $n = 186$; 86 completing CRT first and 97 completing MIL first) and a "not low" group (MIL > 3.61; $n = 426$; 245 completing the CRT first; 185 completing the MIL measure first). Three 2 (MIL: low vs. not low) X 2 (order: CRT first vs. MIL first) ANOVAs were computed, predicting correct answers, heuristic responses, and time spent on the CRT. The interaction was significant for correct answers, $F(1,605) = 4.74$, $p = .03$, and heuristic answers $F(1,607) = 5.06$, $p = .025$, but not for time spent on the task $F(1,605) = 1.73$, $p = .19$. Contrasting the MIL first/low MIL cell with all others showed that this group was higher in performance, $t(605) = 3.57$, $p < .001$, $d = 0.29$, gave fewer heuristic responses, $t(607) = 3.34$, $p = .004$, $d = 0.27$, and took longer to complete the measure, $t(605) = 1.97$, $p = .049$, $d = 0.16$. Those in the "not low" group who rated MIL first gave more heuristic answers than all others, $t(607) = 3.74$, $p < .001$, $d = 0.30$. These results are consistent with the conclusion that low MIL led to higher subsequent reflection. Graphs of the means can be found in the Supplementary Materials.

[3]Dummy coded order (main effect $\beta = .03$, $p = .67$) did not interact with FI (main effect $\beta = .18$, $p = .004$) to predict MIL (interaction $\beta = .03$, $p = .53$). FI was associated with MIL for those who completed the MIL measure prior to the CRT, $r(283) = .17$, $p = .004$; and for those who completed it after the CRT, $r(326) = .22$, $p < .001$. In addition, religiosity (main effect $\beta = .32$, $p < .001$) and order (main effect $\beta = .03$, $p = .87$), did not interact ($\beta = .004$, $p = .94$) to predict MIL; religiosity was associated with MIL regardless of order (r's =.32 and 34 for MIL first and CRT first, respectively, p's <.001). Finally, order did not moderate the associations between the other covariates and MIL (the absolute values of the interaction β's ranged from .006 for PA, $p = .91$, to .09 for openness to experience, $p = .15$).

[4]CRT scores and time to complete the CRT are not included in Table 4 because these variables were affected by the manipulation X MIL^2 interaction. Examining the correlations between the continuous variables and CRT performance among those who completed the CRT first showed significant correlations (r) for the following: PA (-.17), FI (-.26), NC (.19), religiosity (-.25), and extraversion (-.13), all p's $\leq$ .013. For time spent on the CRT, only NC was significantly associated (r = .14, p = .014). As the CRT scores were not normally distributed, these correlations should be viewed as rough estimates.

[5]We also examined the relationship between FI and MIL while accounting for participant age given the use of an adult sample in this study. Age was positively related to MIL (r = .14, p < .001) but it was unrelated to FI (r = .02). Controlling for age, FI remained positively related to MIL, partial r = .19, p < .001.

[6]Time spent on the task did not relate to either of the dependent measures, for MIL, r = .02, p = .63, for FI, r = -.06, p =.12. Time did not interact with dummy coded mindset condition (reflective = 0, intuitive = 1), β = .04, p = .44, or order (MIL first = 0, FI first = 1), β = .03, p = .65, to predict FI; nor did it interact with mindset, β = .06, p = .28, or order, β = .04, p = .48, to predict MIL.

[7]Dropping the predictors for order, when FI was regressed on mindset condition, MIL, the MIL X mindset interaction, MIL^2, and the MIL^2 X mindset interaction with condition, a main effect of MIL, ΔR^2 = .06, p < .001, β = .21, p = .01, was qualified by a significant MIL^2 X mindset interaction, ΔR^2 for the interaction step = .07, β = .18, p = .006. For the equation, R^2 = .08, $F(5, 746) = 10.93$, p < .001.

[8]As in Study 4, to insure that these results did not represent an unusual group of individuals, we split MIL into quartiles (n's = 193; 188, 193, 178 for lowest to highest quartiles, respectively) and computed a 4 (MIL) x 2 (mindset) ANOVA on FI (all cell n's $\geq$ 85). Main effects for MIL $F(3, 744) = 8.83$, p < .001, and mindset condition, $F(1,744) = 10.33$, p = .001, were qualified by a marginally significant interaction, $F(3,744) = 2.41$, p = .066. Because we had predicted that effects would be strongest for the highest levels of MIL we probed this interaction further. Bonferroni corrected, the high MIL/intuitive mindset group was higher on FI (M = 5.70) than all others, p < .05. Contrasting this group against all others, $t(744) = 5.89$, p < .001, d = 0.43. In addition, it is notable that among those low in MIL, the reflection

manipulation led to the lowest levels of FI (M = 4.62), contrasted against all other groups, $t(744) = 3.44$, $p = .001$, $d = 0.25$. These results show that those who were high in MIL were particularly responsive to an induction of intuitive mindset. In contrast, those low in MIL were more susceptible to the reflective mindset instructions. A graph of the means for all groups can be found in the Supplementary Materials.

[9] One way to test this idea is to examine whether the association between FI and MIL might show an additional inflection: a steep positive association at low levels of MIL that flattens at midrange and then continues in a positive direction (essentially testing the cubic contribution of MIL to FI). Analyses using Study 5 data did not support this proposal (β for $MIL^3 = .06$, $p = .62$; for MIL^3 X mindset condition, $\beta = .10$, $p = .42$). Of course, these analyses are completely exploratory. With the exception of Study 5, we did not expect the curvilinear relations we found in the present datasets and suggest that additional examination of this possibility be considered in future research.

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Table 1. Descriptive Statistics and Correlations Among Measures, Study 3

	PA	**FI**	**NC**	**Rel.**	**NS**	**ND**	**SE**	**MIL**	**Partial *r*, for FI & MIL , controlling for…**
Positive Affect(PA)	***.96***	.21**	.15**	.09**	.31**	-.26**	.44**	.37**	.25**
Faith in Intuition (FI)		***.81***	.15**	.09**	.33**	.03	.28**	.31**	--
Need for Cognition (NC)			***.65***	.04	-.02	.05	.04	.23**	.28**
Religiosity (Rel.)				--	.13**	-.05	.13**	.27**	.29**
Need Satisfaction (NS)					***.84***	.08*	.41**	.29**	.23**
Need Dissatisfaction (ND)						***.81***	-.38**	-.20**	.32**
Self-esteem (SE)							***.90***	.36**	.23**
Meaning in Life (MIL)								***.90***	**--**
M(SD)	5.12	5.12	4.55	0	5.31	4.06	4.78	4.53	
	(1.32)	(1.02)	(1.0)	(1)	(0.91)	(1.08)	(0.94)	(1.48)	

Note. N's range from 1008 (for self-esteem) to 1026 (for all other measures); ***p* < .005; **p* < .05. Coefficients on the diagonal are α reliabilities. Religiosity was measured with a standardized composite of ratings for the importance of one's religious identification and the statement "I am a religious person." Meaning in Life was measured with the MLQ presence of meaning subscale. The final column presents the partial correlations between FI and MIL, controlling for that measure.

Table 2. Meaning in Life as a function of CRT performance, collapsing across orders, Study 4

Correct Answers	***n***	**MIL *M*(*SD*)**	**95% CI**	**Heuristic Answers**	***n***	**MIL *M*(*SD*)**	**95% CI**
0	249	4.61 (1.46)	[4.42, 4.79]	0	176	4.08 (1.67)	[3.84, 4.31]
1	113	4.54 (1.51)	[4.27, 4.80]	1	124	4.47 (1.70)	[4.19, 4.75]
2	100	4.38 (1.67)	[4.07, 4.69]	2	154	4.51 (1.50)	[4.26, 4.76]
3	147	3.97 (1.71)	[3.70, 4.28]	3	157	4.61 (1.42)	[4.36, 4.86]

Note. MIL= meaning in life; CRT = Cognitive Reflection Task. For correct answers, $F(3,605) = 5.33$, $p = .001$, partial $\eta^2 = .03$. Those scoring 3 correct answers were significantly lower on meaning in life than the 0 and 1 groups, Bonferroni corrected, $p < .05$. For heuristic answers, $F(3,607) = 3.72$, $p = .011$, partial $\eta^2 = .02$. Those providing 0 heuristic answers were significantly lower than those providing 3 such answers, Bonferroni corrected, $p < .05$. Confidence intervals are bootstrapped with 1000 resamplings.

Table 3. Predicting Reflection from MIL, MIL,^{2} and Mood for those completing MIL prior to the CRT, Study 4

Criterion	*B(SE)*	*95% CI for B*	*β*
Correct Answers			
Constant	1.05	[0.86, 1.24]	
Positive Affect	-0.32(.08)	[-0.47, -0.17]	-.26**
Negative Affect	-0.14(.08)	[-0.30, 0.01]	-.11
Meaning in Life (MIL)	-0.11(.08)	[-0.27, 0.047]	-.09
MIL^2	.16(.07)	[0.04, 0.29]	.15*
Heuristic Answers			
Constant	1.65 (.09)	[1.47, 1.83]	
Positive Affect	0.24(.07)	[0.10, 0.39]	.21**
Negative Affect	0.91(.08)	[-.06, 0.24]	.07
Meaning in Life (MIL)	0.10 (.08)	[-.06, 0.25]	.08
MIL^2	-0.16(.06)	[-0.28, -0.04]	-.15*
Time Spent on Task (sec)			
Constant	18.06(3.63)	[10.9, 25.20]	
Positive Affect	0.44 (2.95)	[-5.37, 6.24]	.01
Negative Affect	2.98(2.95)	[-2.8, 8.79]	.06
Meaning in Life (MIL)	-2.76(3.09)	[-8.82. 3.33]	-.06
MIL^2	5.56(2.49)	[0.66, 10.45]	.14*

Note. $N = 284$; ** $p < .01$; *$p < .05$. CRT = Cognitive Reflection Task

Table 4. Descriptive Statistics and Correlations Among Continuous Measures, Study 4

	PA	NA	FI	NC	Rel.	ES	E	O	A	C	MIL	Partia contr
PA	***.94***	-.28**	.22**	.15**	.28**	.33**	.37**	.18**	.33**	.21**	.42**	.11**
NA		***.92***	-.04	-.22**	-.02	-.46**	-.15**	-.26**	-.31**	-.28**	-.31**	.19**
FI			***.93***	-.05	.09*	.03	.15**	.18**	.22**	.09*	.19**	--
NC				***.81***	-.08	.36**	.12**	.38**	.18**	.34**	.17**	.20**
Rel.					***.91***	.39**	.15**	-.03	.17**	.13**	.33**	.17**
ES						***.68***	.23**	.22**	.37**	.44**	.32**	.19**
E							***.60***	.34**	.22**	.11*	.31**	.15**
O								***.42***	.34**	.15**	.25**	.15**
A									***.31***	.27**	.33**	.13**
C										***.52***	.30**	.17**
MIL											***.93***	
M	4.06	2.06	4.51	5.06	0	4.79	3.65	5.07	5.15	5.22	4.40	
(SD)	(1.55)	(1.27)	(1.11)	(0.99)	(1)	(1.56)	(1.66)	(1.31)	(1.23)	(1.33)	(1.58)	

N's range from = 605-614. ** $p < .005$; * $p < .05$. PA = Positive Affect; NA= Negative Affect; FI= Faith in Intuition; NC=Need for Cognition; Rel.= Religiosity; ES = emotional stability; E= extraversion; O= Openness to Experience; A= Agreeableness; C= Conscientiousness; MIL= Meaning in Life. For the Big Five traits, coefficients on the diagonal are inter-item correlations for the TIPI. For all others, they are α's. Religiosity is a standardized composite of intrinsic religiosity and religious commitment. The last column is the partial correlations for FI and MIL controlling for each other measure. MIL was measured using the MLQ presence of meaning subscale.

Table 5. Meaning in Life as Function of Mindset Condition, Study 5

	N	*M(SD)*	95% CI	JZS Bayes
Overall				16.78
-Reflective Condition	363	4.62 (1.54)	[4.46, 4.77]	
-Intuitive Condition	389	4.64(1.58)	[4.48, 4.80]	
High Time Spent Writing[a]				5.42
-Reflective Condition	86	4.67(1.61)	[4.31, 4.99]	
-Intuitive Condition	64	4.90(1.67)	[4.49, 5.29]	
High Time, *MIL first*				1.64
-Reflective Condition	31	4.45(1.88)	[3.77, 5.13]	
-Intuitive Condition	39	5.10 (1.53)	[4.57, 5.55]	

Note. None of the condition differences are statistically significant, all p's > .10. [a]Time $\geq$ 6.6 minutes, representing the top quartile. CI = confidence interval with boostrapped with 1000 resamplings. JZS Bayes = Jeffrey-Zellner-Siow Prior Bayes factor or the factor by which results support the null over the alternative hypothesis.

Figure Captions

Figure 1. Generated regression line showing a curvilinear relationship between CRT performance and MIL, collapsing across orders, Study 4.

Figure 2. Generated regression lines predicting CRT performance (top panel) and time spent on the CRT (bottom panel), as a function of MIL and order condition, Study 4.

Figure 3. Generated regression line showing a curvilinear relationship between FI and MIL for the entire sample, Study 5.

Figure 4. Generated regression lines predicting FI as a function of MIL and mindset condition, Study 5.

Figure 5. Generated regression line showing a curvilinear relationship between FI and MIL for Studies 1-3.

Figure 1. Meaning in Life predicting CRT performance, Study 4

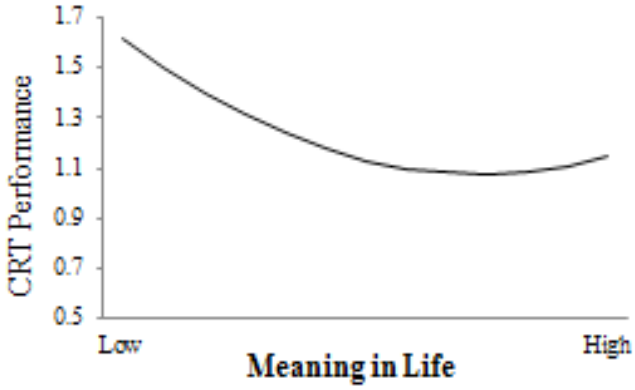
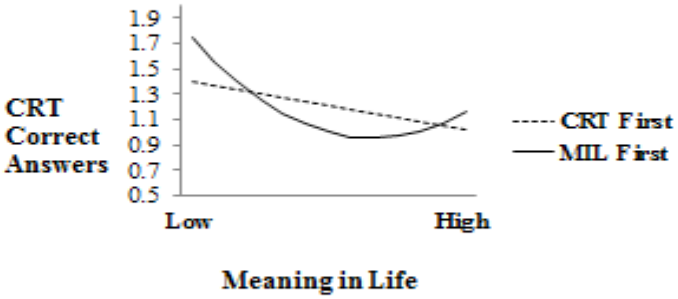


Figure 2. Generated Regression Lines of Meaning in Life Predicting Reflection as a Function of Order, Study 4


CRT Correct Answers
1.9
1.7
1.5
1.3
1.1
0.9
0.7
0.5
Low
High
Meaning in Life
CRT First
MIL First

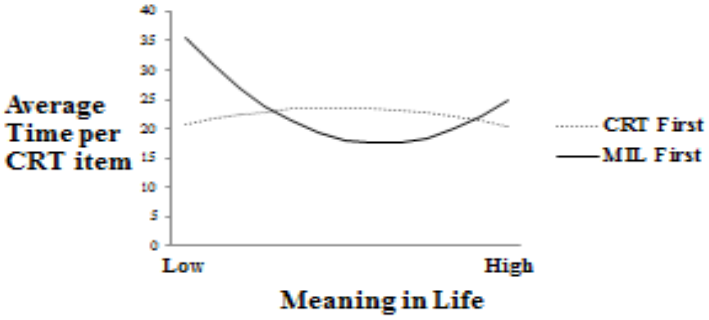

Average Time per CRT item
40
35
30
25
20
15
10
5
0
Low
High
Meaning in Life
CRT First
MIL First

Figure 3. Quadratic effect of MIL on FI, Study 5

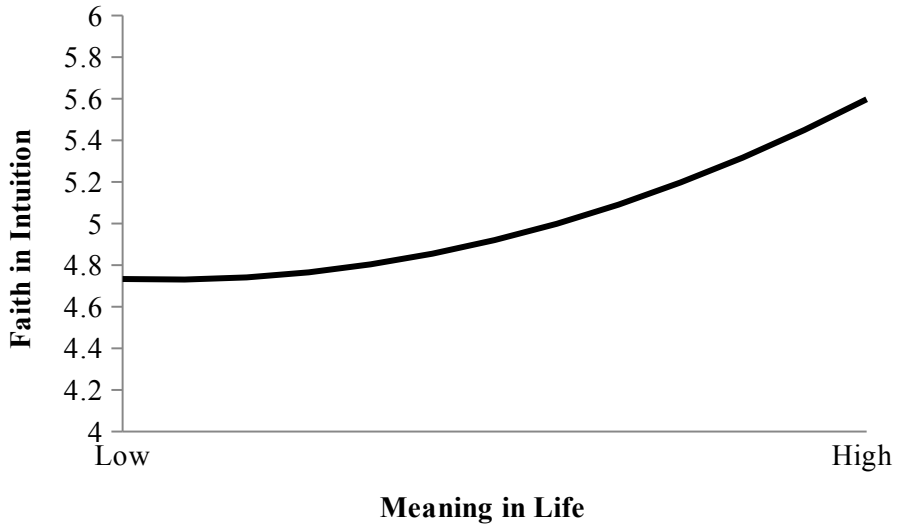


Figure 4. FI as a function of MIL and Mindset Manipulation, Study 5

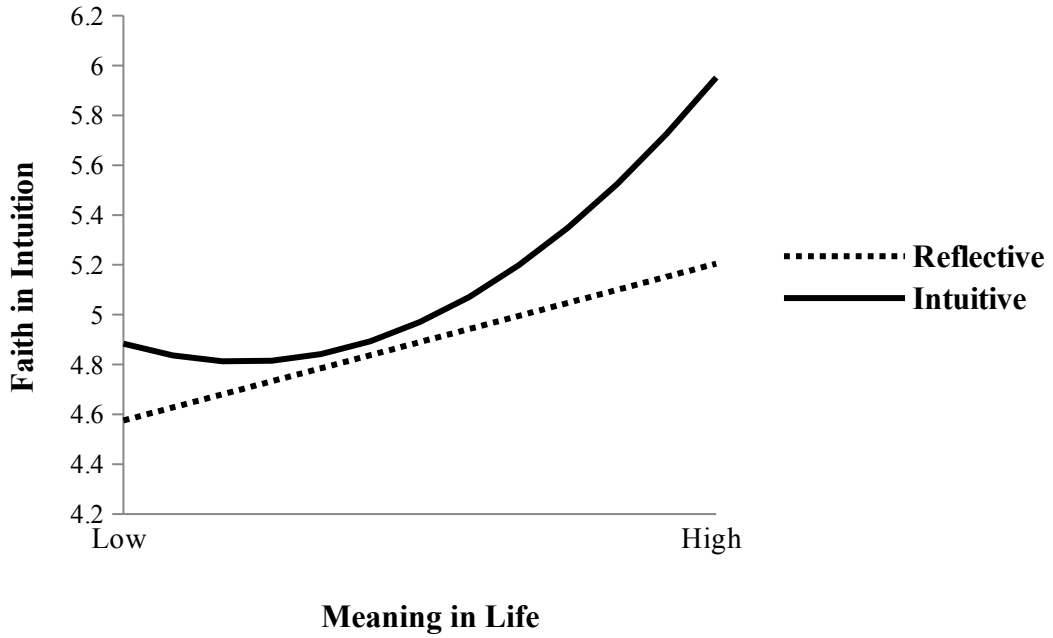


Figure 5. Curvilinear Relationship between Meaning in Life and Faith in Intuition, Studies 1-3