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Free, Connected, and Meaningful:

Free Will Beliefs Promote Meaningfulness Through Belongingness

Andrew B. Moynihan and Eric R. Igou

University of Limerick

&

Wijnand A. P. van Tilburg

King's College London

Author Note

Andrew B. Moynihan, Department of Psychology, University of Limerick; Eric R. Igou, Department of Psychology, University of Limerick, Republic of Ireland; Wijnand A. P. van Tilburg, Department of Psychology, King's College London, United Kingdom.

Correspondence should be sent to Andrew B. Moynihan, Department of Psychology, Main Building, University of Limerick, Castletroy, Co. Limerick, Republic of Ireland;

E-mail: andrew.moynihan@ul.ie

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Abstract

Previous research suggests that belief in free will helps to inhibit anti-social impulses. As a result, belief in free will enables the creation of and participation in society. Consistently, we propose that belief in free will is associated with a sense of belongingness. As previous research indicates that belongingness is a source of meaning in life, we predicted that belief in free will in turn facilitates increased meaningfulness via feelings of belongingness. To test this hypothesis, we conducted two preliminary, small-scale studies and a large-scale study using individual difference data. As expected, in Study 1, the positive association between free will beliefs and meaningfulness was mediated by feelings of belongingness. In Study 2, this effect emerged using alternative measures of free will belief and belongingness, adding to the findings' reliability and validity. In Study 3, these effects were again replicated with a large sample of participants using separate and composite measures of free will belief and belongingness. Finally, we conducted multiple group comparisons and meta-analyses. These confirmed that the proposed correlations and indirect effects were significant and consistent across studies. Our findings provide important understandings of the functions and consequences of free will beliefs.

Keywords: free will, belongingness, meaning, self-regulation, existential psychology

Free, Connected, and Meaningful: Free Will Beliefs Promote Meaningfulness Through Belongingness

Belief in free will has been conceptualized as thinking that people and the self are free from internal (e.g., genes, personality) or external (e.g., fate) constraints, capable of controlling and being responsible for their actions, and directing their actions to achieve desired goals involving high levels of conscious thought and deliberation (Monroe & Malle, 2010; Stillman, Baumeister, & Mele, 2011). Belief in free will is embedded in cultures worldwide (Sarkissian et al., 2010), which explains why many people may adopt such beliefs (Baumeister & Brewer, 2012; Paulhus & Carey, 2011). These beliefs originate from the perceived match between one's conscious thoughts and observed actions (Wegner, 2003; Wegner & Wheatley, 1999) and are based on the premise that different behavioral choices exist (Monroe & Malle, 2010): one is also capable of doing otherwise (Berger & Ramon, 2013; Bertelsen, 2011; Feldman, Baumeister, & Wong, 2014). Thus, the experience of free will is based on the understanding that one's thoughts are responsible for implementing and controlling one's actions (Wegner, 2005). Subsequently, people believe that they have the power to control their own behavior and that they are ultimately responsible for it (Feldman et al., 2014).

Philosophers and psychologists suggested that whether free will actually exists or not, life could appear meaningless without believing in it (e.g., Flanagan, 1996). This is an important point because people have existential needs to experience meaning in life (e.g., Greenberg, Koole, & Pyszczynski, 2004). Personal choice over one's outcomes provided by free will beliefs makes events and experiences seem more meaningful because the action chosen was selected from several possibilities (Seto, Hicks, Davis, & Smallman, 2014). If people believed that their choices were deterministically governed, whatever they said or did would be construed as the only choice they had and would diminish the appeal of their

actions and ultimately the significance of their existence (Bergner & Ramon, 2013). In a similar context, several researchers argue that belief in free will subsumes choice and control (Baumeister, Crescioni, & Alquist, 2011; Feldman et al., 2014; Stillman et al., 2011). A sense of control is an important basis of meaning because it promotes other fundamental meaning sources such as self-esteem and certainty (Heine, Proulx, & Vohs, 2006; Shariff, Schooler, & Vohs, 2008). Indeed, Crescioni, Baumeister, Ent, Ainsworth, and Lambert (2016) recently found that belief in free will led participants to set more meaningful, future goals. Thus, strong belief in free will likely promotes meaningfulness (Crescioni et al., 2016; Seto et al., 2014).

Many existential needs are also met in human relationships, including the need for meaning (Baumeister, 2005; Stillman et al., 2009). Of note, belongingness is a key source of meaningfulness (Heine et al., 2006; Williams, 2002). Belongingness promotes meaningfulness through several mechanisms, including social identity, inclusion, successful pursuit of valued goals (being a helpful individual, feeling appreciated and validated by others; Heine et al., 2006; Van Tilburg & Igou, 2011, 2013; Williams, 2002), as well as gaining access to resources and control over one's environment (Stillman, Lambert, Fincham, & Baumeister, 2011). Several meaning threats (e.g., mortality salience, loneliness) promote strivings for belongingness to re-affirm meaningfulness (e.g., Harmon-Jones, Greenberg, Solomon, & Simon, 1996; Stillman et al., 2009). In a similar vein, being denied feelings of belongingness reduces the perceived meaningfulness of life (e.g., Zadro, Williams, & Richardson, 2004). Indeed, a lack of belongingness, for example represented by ostracism (Williams, 2002), social exclusion (Stillman et al., 2009), or loneliness (Zhou, Sedikides, Wildschut, & Gao, 2008) causally reduces perceived meaning. Furthermore, exclusion impairs self-regulation. Accordingly, some researchers suggested that belongingness may be a fundamental reason to self-control (Baumeister, DeWall, Ciarocco, & Twenge, 2005;

Twenge, Baumeister, Tice, & Stucke, 2001; Twenge, Catanese, & Baumeister, 2002). In sum, people have pronounced belongingness needs that serve a variety of important functions, including providing people with a sense of meaning.

1.1 An Adaptive Function of Belief in Free Will: Belongingness

Regarding our discussion on belongingness, various scholars point out that belief in free will also has important *societal* implications (Baumeister, Sparks, Stillman, & Vohs, 2008; Vohs & Baumeister, 2010). These scholars argue that belief in free will impacts on basic conscious and unconscious processes related to self-control (e.g., intentional binding, intentional inhibition, voluntary motor preparation) and perceptions of self-control (Aarts & Van den Bos, 2011; Lynn, Muhle-Karbe, Aarts, & Brass, 2014; Rigoni, Kühn, Gaudino, Sartori, & Brass, 2012). As such, belief in free will encourages thoughtful reflection and willingness to exert effort to overcome automatic, anti-social impulses (e.g., Baumeister, Crescioni, & Alquist, 2011; Stillman & Baumeister, 2010a), resulting in socially desirable and harmonious actions (Baumeister, 2008a).

For example, Stillman, Baumeister, et al. (2011) found that actions perceived to be free are seen as essential in achieving moral behavior. Indeed, several researchers reported an association between free will beliefs and moral responsibility (e.g., Clark et al., 2014; Nahmias, Morris, Nadelhoffer, & Turner, 2005; Shariff et al., 2014): Bergner and Ramon (2013) reported that belief in free will correlated positively with endorsing morality as an important dimension of life and with maintaining higher personal moral standards. MacKenzie, Vohs, and Baumeister (2014) also found that free will belief predicted gratitude that is in turn linked to pro-social behavior and enhancing close relationships. Collectively, these behaviors are enacted, at least in some circumstances, to gain acceptance, facilitating social bonds (e.g., Gordon, Impett, Kogan, Oveis, & Keltner, 2012), and serving the need to

belong (Baumeister & Leary, 1995). Thus, we argue that free will beliefs are associated with feelings of belongingness.

Consistently, researchers suggested that belief in free will is a functional cultural belief (e.g., Baumeister et al., 2009; Bertelsen, 2011) that contributed to the cultural evolution of humans (Baumeister et al., 2008). To comprehend its link to feelings of belongingness, one must understand that belongingness is a core human need (Baumeister & Leary, 1995) because it provides many benefits (e.g., increased food supply, environmental protection; Baumeister, 2005). Therefore, humans regulate their behavior in order to facilitate belongingness (Baumeister, 2008a; Baumeister et al., 2005; Baumeister et al., 2011). That is, individual differences that motivate people to gain acceptance and avoid rejection are essential for survival (Malone, Pillow, & Osman, 2012). Hence, Baumeister (2005) argues that basic psychological beliefs and mechanisms provided a basis for initiating and later evolved to maintain bonds with one's social group.

In this regard, many researchers argue that belief in free will developed sequentially in human psychology (Baumeister, 2005, 2008b; see also Baumeister et al., 2011). Initiative, facilitated by a basic form of free will belief, is believed to have developed before humanity became a mainly social species to enable animals to navigate the physical environment to satisfy their motivations (e.g., finding food). Becoming more social during evolution gave humanity and its ancestors an evolutionary advantage (Barchas, 1986; Baumeister, 2005, 2008a, 2008b). As evolution tends to build on the past and modifies existing systems (Allman, 1999), belief in free will and its related psychological capacities (e.g., initiative) likely emerged first to improve survival and reproduction and later adaptations built on that capacity and adapted it to new developments in the social environment (Baumeister et al., 2011).

To be social, humanity must have had these basic free will beliefs and their related inner structures as a capacity for co-operating with others within the cultures of these groups (Baumeister, 2008b). In an evolutionary sense, free will beliefs would have been essential in a culture that involves rules and interdependent roles that require exercising self-control and restraining automatic, anti-social impulses (Baumeister, 2008a, 2008b; Baumeister et al., 2008). Therefore, belief in free will may have developed further as an adaptation to meet the escalating demands of, opportunities intrinsic to, and facilitate a new form of human social living. These beliefs and related psychological capacities would have helped people to override their automatic selfish impulses that demanded greater mental energy and self-regulatory resources (Baumeister et al., 2011; DeWall, Baumeister, Gailliot, & Maner, 2008; DeWall, Baumeister, Stillman, & Gailliot, 2007). Again, this effortful form of self-regulation to restrain selfish impulses seems to be enacted for the purpose of belongingness (Baumeister et al., 2005; Twenge et al., 2001; Twenge et al., 2002). Indeed, empirical evidence shows that belief in free will causally effects pro-social behavior that benefits belongingness to groups (e.g., Baumeister et al., 2009; Stillman & Baumeister, 2010b; Vohs & Schooler, 2008).

Beyond these additional benefits however, being a part of a group helped to satisfy people's fundamental need to belong. Belief in free will was functional for adherence to rules and norms, which were important to gain acceptance and approval into society (Baumeister et al., 2011). That is, belief in free will helped people to restrain their impulses so as to gain acceptance and approval from groups, which in turn promoted feelings of belongingness (e.g., Baumeister, 2008b).

Again, one of the great benefits that feelings of belongingness offer is that they serve as a key source of perceived meaning in life (Heine et al., 2006; Stillman et al., 2009; Williams, 2002). Building on these findings, we argue that belief in free will also promotes a sense of belongingness by controlling non-social and selfish behaviors for acceptance to and

membership of social groups (Baumeister, 2005; Baumeister et al., 2011). Therefore, we argue that free will belief also *indirectly* enhances meaning in life through these feelings of belongingness. That is, meaning in life substantiates the relationship between free will beliefs and belongingness.

1.2 Free Will Adds to Meaning in Life via Belongingness

In sum, prior research suggests that belief in free will promotes behaviors associated with a sense of belongingness (e.g., Baumeister et al., 2009; Baumeister et al., 2011), even though empirical tests of this proposed association seem to be lacking. Crucial for our hypothesis is previous research that established causal relationships between free will beliefs and behaviors related to belongingness (e.g., MacKenzie et al., 2014; Shariff et al., 2014; Stillman & Baumeister, 2010b) and between belongingness and presence of meaning in life (e.g., Stillman et al., 2009; Williams, 2002). Two independent, experimental lines of research thus demonstrated that belief in free will *causes* behaviors associated with increased belongingness and that belongingness *causes* increased perceived meaning in life. We integrated these notions into our proposed mediation model. Specifically, we hypothesized a relationship between belief in free will and a sense of belongingness that ultimately promotes meaningfulness. In other words, we predicted (1) a relationship between free will beliefs and perceived meaningfulness and (2) that this relationship would be mediated, at least in part, by feelings of belongingness. To our knowledge, previous research has not tested our proposed model. By testing these novel predictions, we aimed at integrating two research traditions—one on free will and the other on perceived meaning in life—by demonstrating how the relationship between free will beliefs and belongingness are substantiated by meaningfulness. Indeed, our hypothesis expands on research by Crescioni et al. (2016) by noting another pathway between free will beliefs and meaningfulness via feelings of belongingness rather than by setting meaningful goals. We conducted three studies that focused on individual

differences. Studies 1 and 2 were preliminary tests of our hypothesis and Study 3 was a larger scale study. All studies included a measure of belief in free will, a measure of belongingness as a mediating variable, and a measure of perceived meaning in life.

2. Study 1

2.1 Method

2.1.1 Participants and design. Ninety participants were recruited in exchange for €0.24 ($M_{age} = 28.38$, $SD = 8.81$, age range = 18-63; 37 women, 53 men). There were 35 US Americans, 29 British, and 20 people with other nationalities. Seventy-two were Caucasian, 9 had Asian ethnicity, 3 were Black, and the remaining 5 had other ethnicities. We recruited participants using the Prolific Academic website (www.prolificacademic.co.uk). This facility has been developed for web-based research by academic researchers in exchange for payment.

2.1.2 Pre-test. First, we conducted a pre-test to confirm a direct relationship between free will beliefs and meaningfulness. We recruited fifty participants via prolificacademic.co.uk ($M_{age} = 28.92$, $SD = 10.30$, age: 18-53; 26 men, 24 women). Participants completed Steger, Frazier, Oishi, and Kaler's (2006) presence of meaning subscale ($\alpha = .91$). We measured belief in free will with the personal free will subscale from the free will and determinism scale ($\alpha = .84$; Rakos, Laurene, Skala, & Slane, 2008). Our analysis showed a significant, positive correlation between belief in free will and presence of meaning in life, $r(48) = .30$, $p = .04$, consistent with our hypothesis and previous literature (Crescioni et al., 2016). Having established that belief in free will had a relationship with meaningfulness, we proceeded to test whether free will would predict meaningfulness through increased feelings of belongingness.

2.1.3 Materials and procedure. Participants gave their informed consent and provided demographic details. Next, they completed three scales randomized in order. Belief

in free will was measured with the free will subscale of the free will and determinism scale – plus (Paulhus & Carey, 2011), consisting of seven items (e.g., “People have complete control over the decisions they make”; 1 = *strongly disagree* – 7 = *strongly agree*; $M = 4.85$, $SD = 1.01$; $\alpha = 0.79$). This scale was used in previous research on the effects of free will beliefs (e.g., Baumeister et al., 2009; Vohs & Schooler, 2008). We assessed belongingness with the general belongingness scale (Malone et al., 2012). This 12-item scale has been extensively validated (e.g., “I feel connected with others”; $M = 5.25$, $SD = 1.07$; $\alpha = .92$). We measured meaning in life with the validated presence of meaning in life scale, a subscale of the meaning in life questionnaire (Steger et al., 2006), consisting of five items (e.g., “I have a good sense of what makes my life meaningful”; 1 = *absolutely untrue*, 7 = *absolutely true*; $M = 4.89$, $SD = 1.38$; $\alpha = .91$). Afterwards, participants were thanked and debriefed.

All studies were approved by the institution’s Research Ethics Committee. In all studies, participants were told that their data would be treated confidentially and they had a right to withdraw at any time.

2.1.4 Data screening. The distribution of presence of meaning in life scores was significantly negatively skewed when investigated using the Shapiro-Wilks test, $S-W = 0.95$, $df = 90$, $p = .002$. This skew was counteracted by conducting inverse and logarithmic transformations on those scores, $S-W = 0.98$, $df = 90$, $p = 0.09$. All scores were standardized to prevent multicollinearity (Tabachnick & Fidell, 2013) and to maintain consistency between the three scales.

2.2 Results and Discussion

2.2.1 Correlations. Free will beliefs correlated positively and significantly with presence of meaning in life, $r(88) = .32$, $p < .005$, and with belongingness, $r(88) = .23$, $p = .03$. Further, we found a significant, positive correlation between belongingness and meaningfulness, $r(88) = .56$, $p < .001$. According to guidelines developed by Cohen (1988),

the effect sizes of these correlations were medium, small, and large respectively. Collectively, these relationships were in accordance with our predictions.

2.2.2 Mediation analysis. To test our hypothesis that belief in free will fosters meaningfulness by imbuing life with a sense of belongingness, we conducted a mediation analysis using Hayes' (2012, Model 4) PROCESS macro. Belief in free will was entered as the predictor variable in the model. Belongingness was entered as the mediating variable and presence of meaning as the outcome variable. The direct effect of free will on presence of meaning remained significant after including the proposed mediator, $B = 0.20$, $SE = 0.09$, $p = .03$. Importantly, and as predicted, there was a significant indirect effect of belief in free will on presence of meaning through belongingness, $ab = 0.12$, $SE = 0.05$, 95% CI [0.02, 0.22], estimated using 10,000 bias-corrected bootstraps (Hayes, 2013). Thus, feelings of belongingness mediated the relationship between belief in free will and presence of meaning (Figure 1).

The data support our mediation model, formulated based on earlier experimental research (e.g., Baumeister et al., 2009; Shariff et al., 2014; Stillman & Baumeister, 2010b), in which the association between belief in free will and meaningfulness was transmitted by a sense of belongingness. This finding is in accordance with our hypothesis and, to our knowledge, has not been demonstrated in previous research. In addition, we believe that Study 1 is the first instance in which belief in free will has been empirically linked to feelings of belongingness. We conducted a complementary study, with alternative measures, to test whether the same pattern would emerge with different operationalizations of the core concepts.

3. Study 2

In Study 2, we used alternative measures of free will beliefs and belongingness. Again, we predicted that belief in free will is positively associated with presence of meaning in life, mediated by feelings of belongingness.

3.1 Method

3.1.1 Participants and design. Eighty-one participants were recruited ($M_{age} = 28.63$, $SD = 9.84$, age range = 18-56; 43 women, 38 men) from Prolific Academic in exchange for a €0.24 remuneration. Demographics were 43 British, 19 US Americans, and 14 other nationalities. Sixty-four were Caucasian, 7 were Asian, and the remainder consisted of 4 other ethnicities. All participants reported acceptable English language ability.

3.1.2 Materials and procedure. First, participants gave informed consent and reported demographics. Three scales were then presented in random order. Belief in free will was assessed using the personal free will subscale of the free will and determinism scale (Rakos et al., 2008). This scale contains eight items (e.g., “I am in charge of the decisions I make,”; 1 = *strongly disagree*, 7 = *strongly agree*; $M = 5.57$, $SD = 0.81$; $\alpha = .78$).

To measure belongingness, we measured the reverse-scored UCLA loneliness scale (version 3; Russell, 1996). This scale consists of twenty items (e.g., “How often do you feel close to people?”; 1 = *never*, 4 = *always*, $M = 4.31$, $SD = 0.43$; $\alpha = .91$). The scale has been recommended for studies that examine feelings of belongingness and identifies those who are not lonely (Cacioppo, Hawkley, & Bernsten, 2003). For example, reverse scoring items on the UCLA loneliness scale has been shown to endorse feelings of non-loneliness (Russell, Peplau, & Cutrona, 1980). Indeed, a confirmatory factor analysis showed that the scale measures a bipolar loneliness factor with lower scores indicating greater social engagement (Russell, 1996). Furthermore, prior research has also shown that low levels of loneliness are associated with fulfilled belongingness needs and satisfaction with personal relationships

(Mellor, Stokes, Firth, Hayashi, & Cummins, 2008). We included the presence of meaning subscale as in Study 1 ($M = 4.92$, $SD = 1.17$; $\alpha = .85$; Steger et al., 2006). Afterwards, participants were thanked and debriefed.

3.1.3 Data screening. The presence of meaning scores showed a significant negative skew, $S-W = 0.97$, $df = 81$, $p = .04$. We counteracted this skew by conducting inverse and logarithmic transformations on scores for that construct, $S-W = 0.98$, $df = 81$, $p = .27$. Again, all scores were standardized to prevent multicollinearity (Tabachnick & Fidell, 2013) and to maintain consistency between the three scales.

3.2 Results and Discussion

3.2.1 Correlations. As predicted, belief in free will correlated positively and significantly with presence of meaning in life, $r(79) = .23$, $p = .04$. There was a significant, positive correlation between belief in free will and the reverse-scored loneliness scale, $r(79) = .27$, $p = .02$. Similarly, presence of meaning correlated positively and significantly with the reverse-scored loneliness scale, $r(79) = .46$, $p < .001$. According to guidelines developed by Cohen (1988), the effect sizes of these correlations were small and medium respectively. Collectively, these relationships were in accordance with our predictions and Study 1's findings.

3.2.2 Mediation analysis. The hypothesized mediation model was evaluated using Hayes' (2012, Model 4) PROCESS macro. Belief in free will was entered as the predictor variable in the model, reverse loneliness was the mediator, and meaningfulness was the outcome variable (Figure 2). We found a significant indirect effect of belief in free will on meaningfulness through belongingness, $ab = 0.11$, $SE = 0.06$, 95% CI [0.03, 0.26], estimated using 10,000 bias-corrected bootstraps (Hayes, 2013). The direct effect became non-significant after including the mediator, $B = 0.12$, $SE = 0.10$, $p = .25$.

The data support our theoretical model. Specifically, the results support our hypothesis that belief in free will predicts perceived meaningfulness, mediated by a sense of belongingness, using different measures of free will and belongingness than in Study 1. Again, to our knowledge, this relationship has not been identified in previous research. As a more robust test of our hypothesis, we aimed to replicate the indirect effects from the preliminary tests, Studies 1 and 2, in a substantially larger sample that amalgamated the free will belief and belongingness measures.

4. Study 3

4.1 Method

4.1.1 Participants and design. Two hundred and sixty-eight participants were recruited via MTurk in exchange for €0.23 ($M_{age} = 36.70$, $SD = 12.64$, age range = 18-74; 144 women, 122 men). Two hundred and thirty-four participants were US American and the remaining participants constituted 14 other nationalities. Two hundred and nineteen participants were Caucasian, 19 were Asian, 15 were Black, and the remaining participants had other ethnicities. All participants reported acceptable English.

4.1.2 Materials and procedure. Participants gave their informed consent and reported demographics. Next, the five scales from the previous two studies were presented to participants in a random order. That is, participants completed two measures of belief in free will, one on presence of meaning, and two on perceived belongingness. Again, the belief in free will scales were the free will subscale of the free will and determinism scale – plus (Paulhus & Carey, 2011), consisting of seven items (e.g., “People have complete free will”; 1 = *strongly disagree* – 7 = *strongly agree*; $M = 5.34$, $SD = 1.09$; $\alpha = 0.87$) and the personal free will subscale of the free will and determinism scale (Rakos et al., 2008), consisting of eight items, (“I actively choose what to do from among the options I have.”; 1 = *strongly disagree*, 7 = *strongly agree*; $M = 5.54$, $SD = 0.90$; $\alpha = 0.78$). Meaningfulness was measured

using the five-item presence of meaning subscale from the meaning in life questionnaire (e.g., “My life has a clear sense of purpose.”; 1 = *absolutely untrue*, 7 = *absolutely true*; $M = 4.93$, $SD = 1.56$; $\alpha = 0.95$; Steger et al., 2006). Belongingness was measured using the ‘general belongingness scale’ (Malone et al., 2012) consisting of twelve items (e.g., “I have a sense of belonging.”; 1 = *strongly disagree*, 7 = *strongly agree*; $M = 4.92$, $SD = 1.41$; $\alpha = .96$) and the reverse-scored UCLA loneliness scale (Russell, 1996), consisting of twenty items (e.g., “How often do you feel that you are “in tune” with the people around you?”; 1 = *never*, 4 = *always*; $M = 2.75$, $SD = 0.62$; $\alpha = .96$). Afterwards, participants were debriefed, thanked, and rewarded.

4.1.3 Data analysis. The free will (Paulhus & Carey, 2011) and the personal free will subscales (Rakos et al., 2008) were transformed using the logarithmic and square root formulas respectively to reduce the impact of outliers. In the mediation analyses reported below, all scores were standardized to prevent multicollinearity (Tabachnick & Fidell, 2013) and to maintain consistency between the scales.

4.1.4 Composites analyses. First, we examined the relationships between our two belief in free will scales and two belongingness scales. As expected, the free will subscale (Paulhus & Carey, 2011) correlated positively and significantly with the personal free will scale (Rakos et al., 2008), $r(265) = .52$, $p < .001$. Furthermore, when the two free will belief scales were amalgamated, the composite had acceptable reliability ($\alpha = .88$; $M = 5.45$, $SD = 0.88$).

Similarly, we examined the relationships between the two belongingness scales. As expected, the general belongingness scale (Malone et al., 2012) correlated positively and significantly with the reverse-scored UCLA scale (Russell, 1996), $r(265) = .91$, $p < .001$. In addition, when the two belongingness scales were amalgamated, the composite had acceptable reliability ($\alpha = .98$; $M = 4.65$, $SD = 1.28$).

These findings suggested that the two sets of scales were appropriate for creating composite measures of free will beliefs and belongingness. In further analyses, scores on the reverse-scored UCLA loneliness scale (Russell, 1996) were transformed from those on a four point scale to that of a seven point scale to maintain consistency between the belongingness scales. To further justify that these sets of scales should be amalgamated, we conducted two exploratory factor analyses.

4.1.5 Factor analyses. First, we conducted an exploratory factor analysis on the 15 belief in free will items. We used the principal axis factoring method for factor extraction with a direct oblimin rotation. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was .91, above the recommended minimum value of .6. In addition, Bartlett's test of Sphericity was significant, $\chi^2(105) = 2386.114, p < .001$, indicating suitability of our data for factor analysis. A subsequent analysis resulted in a one-factor solution accounting for 47.51% of the variance. Factor 1 had an eigenvalue of 7.13 and standardized coefficients ranged from .52 to .81. Based on the factor loadings and internal reliability, we created a composite variable of belief in free will by amalgamating the two free will scales.

Similarly, we conducted an exploratory factor analysis on the 32 items from the two belongingness scales. Again, we used the principal axis factoring method for factor extraction with a direct oblimin rotation. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was .97, above the recommended minimum value of .6. In addition, Bartlett's test of Sphericity was significant, $\chi^2(496) = 7710.052, p < .001$, indicating suitability of our data for factor analysis. A subsequent analysis using a one-factor solution accounted for 59% of the variance. This factor had an eigenvalue of 18.88 and standardized coefficients ranged from .49 to .86. Again, based on the factor loadings and internal reliability, we created a composite variable of belongingness by amalgamating the two belongingness scales.

4.2 Results and Discussion

4.2.1 Correlations. As predicted, the belief in free will composite correlated positively and significantly with presence of meaning in life, $r(265) = .49, p < .001$. In addition, the free will belief composite correlated positively and significantly with the belongingness composite, $r(265) = .45, p < .001$. Presence of meaning also correlated positively and significantly with the belongingness composite, $r(265) = .65, p < .001$. The effect sizes of these correlations were medium (approaching large) and large, respectively (Cohen, 1988). Collectively, these relationships were in accordance with our hypothesis.

4.2.2 Mediation analysis. We tested our proposed indirect effect using Hayes' (2012, Model 4) PROCESS macro. The belief in free will composite was entered as the predictor variable in the model, the belongingness composite was entered as the mediator, and meaningfulness was entered as the outcome variable. As expected, there was a significant indirect effect of belief in free will on meaningfulness through feelings of belongingness, $ab = 0.24, SE = 0.04, 95\% \text{ CI } [0.17, 0.33]$, estimated using 10,000 bias-corrected bootstraps (Hayes, 2013) (Figure 3). The direct effect remained significant, $B = 0.25, SE = 0.05, p < .001$. Thus, we replicated our proposed mediation model in a large-scale study: belief in free will promoted meaningfulness through feelings of belongingness.

4.2.3 Replication: Study 1. Additionally, we investigated whether the indirect effect from Study 1 would replicate with only the specific measures of that prior study. As expected and replicating Study 1, belief in free will (Paulhus & Carey, 2011) correlated positively and significantly with presence of meaningfulness, $r(265) = .46, p < .001$. Belief in free will also correlated positively and significantly with belongingness (Malone et al., 2012), $r(265) = .43, p < .001$. Finally, belongingness correlated positively and significantly with meaningfulness, $r(265) = .63, p < .001$. The effect sizes of these correlations were medium and large respectively (Cohen, 1988).

To test our proposed indirect effect, we used Hayes's (2012, Model 4) PROCESS macro. Again, belief in free will scores were entered as the predictor variable, belongingness was entered as the mediator, and meaningfulness was entered as the outcome variable (all standardized). As expected, there was a significant indirect effect of free will beliefs on meaningfulness through feelings of belongingness, $ab = 0.23$, $SE = 0.04$, 95% CI [0.15, 0.32], estimated using 10,000 bias-corrected bootstraps (Hayes, 2013) (Figure 4). The direct effect remained significant, $B = 0.24$, $SE = 0.05$, $p < .001$. Thus, Study 1's findings were replicated in a larger sample: feelings of belongingness significantly mediated the relationship between free will beliefs and meaningfulness.

4.2.4 Replication: Study 2. Similarly, we investigated if the indirect effect from Study 2 would replicate with only the specific measures of that prior study. As expected and replicating the findings in Study 2, belief in free will (Rakos et al., 2008) correlated positively and significantly with presence of meaning, $r(265) = .34$, $p < .001$. Similarly, belief in free will correlated positively and significantly with the reverse-scored loneliness scale (Russell, 1996), $r(265) = .31$, $p < .001$. Finally, the reverse-scored loneliness scores correlated positively and significantly with meaningfulness, $r(265) = .63$, $p < .001$. The effect sizes of these correlations were medium and large, respectively (Cohen, 1988).

To test our proposed indirect effect, we used Hayes's (2012) PROCESS macro. The belief in free will scores were entered as the predictor variable in the model, reverse-scored loneliness was entered as the mediator, and presence of meaning was entered as the outcome variable (all standardized). As expected, there was a significant indirect effect of belief in free will on presence of meaning through belongingness, $ab = 0.18$, $SE = 0.04$, 95% CI [0.11, 0.27], estimated using 10,000 bias-corrected bootstraps (Hayes, 2013), (Figure 5). The direct effect of belief in free will on meaningfulness remained significant, $B = 0.16$, $SE = 0.05$, $p = .002$. Therefore, Study 1 and 2's findings were replicated in a larger sample: belief in free

will promotes meaningfulness through feelings of belongingness. As a final test of our hypothesis, we conducted multiple group comparisons and meta-analyses of Studies 1-3.

5. Studies 1-3: Meta-Analysis and Multiple Group Comparisons

In Studies 1-3, we found significant, indirect effects of belief in free will on meaningfulness through feelings of belongingness. However, the sample sizes across these studies varied considerably in size. We conducted a meta-analysis on the correlations that composed the mediation model across the three studies as a further test of our hypothesis. In addition, we conducted multiple group comparisons to test if the indirect effects in Studies 1 and 2 were not significantly different from those indirect effects that were composed of the same measures in Study 3.

5.1 Meta-analyses. We conducted three separate meta-analyses for each of the constituent paths in our proposed mediation model. For Study 3, we used the aggregated free will belief and belongingness scores. First, we conducted a meta-analysis on the relationship between free will beliefs and meaningfulness. Data from studies 1-3 and the pre-test were included in this analysis. The random-effects meta-analysis produced a mean effect size for the correlation between free will beliefs and meaningfulness of $d = 0.88$, $SD = 0.27$, 95% CI [0.48, 1.27]. Thus, there was a significant relationship between free will beliefs and meaningfulness across studies (Figure 6).

Next, we conducted a meta-analysis on the relationship between free will beliefs and belongingness. The random-effects meta-analysis including the three studies produced a mean effect size for the correlation between free will beliefs and belongingness of $d = 0.81$, $SD = 0.24$, 95% CI [0.45, 1.16]. Thus, there was a significant relationship between free will beliefs and belongingness across studies (Figure 7).

Finally, we conducted a meta-analysis on the relationship between belongingness and meaningfulness. The random-effects meta-analysis including the three studies produced a

mean effect size for the correlation between belongingness and meaningfulness of $d = 1.51$, $SD = 0.26$, 95% CI [1.12, 1.95]. Therefore, there was a significant relationship between belongingness and meaningfulness across studies (Figure 8).

5.2 Multiple group comparisons. Next, we conducted multiple group comparisons to assess if the indirect effects in Study 3 were not significantly different from the equivalent indirect effects in Studies 1 and 2.

5.2.1 Mediation analysis 1. First, we investigated the indirect effect when data from the same measures in Studies 1 and 3 were combined. As expected, there was a significant indirect effect of belief in free will on meaningfulness through a sense of belongingness, $ab = 0.20$, $SE = 0.03$, 95% CI [0.14, 0.27]. Thus, our findings from Studies 1 and 3 were replicated.

In addition, our analysis showed that the indirect effects that used the same measures in Studies 1 and 3 did not differ significantly from each other, $B = -0.11$, $SE = 0.07$, 95% CI [-0.24, 0.02]. Thus, our conclusions from Studies 1 and 3 have been substantiated.

5.2.2 Mediation analysis 2. Similarly, we investigated the indirect effect when data from the same measures in Studies 2 and 3 were combined. As expected, there was a significant indirect effect of belief in free will on meaningfulness through feelings of belongingness, $ab = 0.16$, $SE = 0.03$, 95% CI [0.10, 0.23]. Therefore, we replicated our findings from Studies 2 and 3.

Finally, we conducted a multiple group comparison to assess if the indirect effect in Study 2 was not significantly different from its equivalent in Study 3. Our analysis showed that the indirect effects in Studies 2 and 3 that used the same measures did not differ significantly from each other, $B = -0.07$, $SE = 0.07$, 95% CI [-0.19, 0.08]. Thus, our conclusions from Studies 2 and 3 have been corroborated.

6. General Discussion

People have existential needs to experience meaning in life (e.g., Greenberg et al., 2004). In this regard, strong beliefs in free will are associated with meaningfulness (Crescioni et al., 2016; Seto et al., 2014). Simultaneously, belongingness is also a source of meaning (Heine et al., 2006; Williams, 2002). Our hypothesis was that belief in free will promotes meaningfulness through feelings of belongingness. We based our hypothesis on previous research that established causal relationships between free will beliefs and behaviors related to belongingness (e.g., MacKenzie et al., 2014; Shariff et al., 2014; Stillman & Baumeister, 2010b) and between belongingness and presence of meaning in life (e.g., Stillman et al., 2009; Williams, 2002). Specifically, we proposed that beliefs in free will are positively associated with a sense of belongingness that in turn promotes a sense of meaningfulness. In other words, we predicted that the relationship between free will beliefs and meaning in life perceptions is transmitted, at least in part, by feelings of belongingness. Across three studies, we found consistent support for our hypothesis, connecting different research domains that collectively had limited empirical findings. In Study 1, we found positive and significant relationships between each of these variables. Additionally, the relationship between free will beliefs and meaningfulness was significantly mediated by feelings of belongingness. In Study 2, we employed different measures of free will belief and belongingness, yielding similar results. In Study 3, we replicated the indirect effects from the earlier studies using a substantially larger sample. In addition, the indirect effect withheld when composite measures of the main constructs were entered into the model. Furthermore, there were no significant differences in the indirect effects between studies that used the same measures. Finally, meta-analyses showed significant relationships between the constructs across Studies 1-3, corroborating our conclusions. We believe that the present research is the first set of

studies to demonstrate that belief in free will promotes meaningfulness through feelings of belongingness and indeed empirically links free will beliefs to feelings of belongingness.

6.1 Belief in Free Will Adds to Meaning in Life via Belongingness

Our findings substantiate previous research claiming that belief in free will has important societal implications (Baumeister et al., 2008; Stillman & Baumeister 2010a). Belief in free will seems to encourage thoughtful reflection and effort to overcome automatic, anti-social impulses (e.g., Baumeister et al., 2011; Stillman & Baumeister, 2010a; Stillman, Baumeister, et al., 2011). These processes seem to benefit interpersonal relations (Baumeister, 2008a). That is, belief in free will may be a functional cultural belief that encourages self-restraint for societal harmony, approval and acceptance into social groups, and thereby facilitates feelings of belongingness (e.g., Baumeister et al., 2009; Bertelsen, 2011).

Our findings also contribute to Baumeister's (2008a, 2008b) theory on the cultural and evolutionary function of belief in free will. Humanity benefitted greatly from creating and participating in the cultures of social groups. Individual differences that motivated people to gain acceptance and avoid rejection were essential for survival (Malone et al., 2012) and thereby to fulfill humanity's need to belong (Baumeister & Leary, 1995). This culture within social groups required a new form of action control to inhibit innate, selfish impulses (Baumeister, 2005, 2008a, 2008b; Baumeister et al., 2011). Building on earlier capacities (e.g., Baumeister et al., 2011), free will beliefs likely enabled humanity to create, participate in, and benefit from culture, by facilitating thoughtful reflection and self-restraint (Baumeister et al., 2008), which ultimately afforded people acceptance into groups and thereby feelings of belongingness. This is because approval is a prerequisite for forming and maintaining social bonds (Baumeister & Leary, 1995). Historically, belief in free will helped

people to restrain their impulses in order to gain acceptance to groups, which in turn promoted feelings of belongingness (e.g., Baumeister, 2008b).

Simultaneously, belongingness is a core human need (Baumeister & Leary, 1995) and a source of meaning (Heine et al., 2006). Free will beliefs seem paramount in order to control anti-social impulses to achieve a sense of belongingness (Baumeister et al., 2009; Vohs & Schooler, 2008). Simultaneously, people's need to belong serves a variety of important functions, including providing people with a sense of meaning (e.g., Heine et al., 2006; Williams, 2002). As a result, at least part of the relationship between free will beliefs and a sense of belongingness can be understood as contributing to a sense of meaningfulness (i.e., meaningfulness substantiates the relationship between free will belief and belongingness). Although previous research has identified that belief in free will promotes meaningfulness by allowing people to set future, meaningful goals (Crescioni et al., 2016), our research extends on the relationship between free will beliefs and meaningfulness that may also occur through a different pathway via feelings of belongingness.

6.2 Practical Applications

Our findings have some practical applications. Stillman, Baumeister, et al. (2011) noted that belief in free will is associated with achieving delayed rather than immediate benefits, a trait that is essential for the functioning of society. In this context, belief in free will predicts better work performance (Stillman et al., 2010) and pro-social behaviors (e.g., MacKenzie et al., 2014; Seto et al., 2014). These positive societal outcomes associated with belief in free will and belongingness may enhance social capital (Putnam, 2000). Ultimately, increased belongingness and social capital could address peoples' meaning needs (Heine et al., 2006) and alleviate maladaptive behaviors associated with meaninglessness (DeWall, Twenge, Gitter, & Baumeister, 2009; Twenge et al., 2003; Vohs & Baumeister, 2010). Clark et al. (2014) suggested that situational factors could be investigated that promote beliefs in

free will and moral behaviors associated with belongingness, considering these positive societal implications (e.g., Baumeister et al., 2009; Vohs & Schooler, 2008). By identifying how free will beliefs are associated with promoting feelings of belongingness and meaningfulness, perhaps the dynamics of these relationships could be fostered in youth development programs (e.g., to promote pro-social behaviors; Siu, Cheng, & Leung, 2006).

6.3 Nature of the Mediation Model

6.3.1 Individual differences. Regarding our proposed model, our hypothesis was based on previous research that established causal relationships between free will beliefs and behaviors related to belongingness (e.g., MacKenzie et al., 2014; Shariff et al., 2014; Stillman & Baumeister, 2010b) and between belongingness and presence of meaning in life (e.g., Stillman et al., 2009; Williams, 2002). Based on these established causal relationships, we are confident in the ordering of variables in our proposed mediation model. Our studies have since extended on these established relationships by highlighting how the two research domains integrate with each other. One limitation of our studies, however, is that they had correlational designs. These designs limit what mediation models can tell empirically about the causal and long-term relationships between constructs. Our choice of the studies' designs was partly based on the fact that the model was composed of established causal relationships, that belief in free will is a relatively stable trait (Baumeister & Brewer, 2012; Paulhus & Carey, 2011), and is culturally universal (Sarkissian et al., 2010). Additionally, continuous predictor variables are acceptable to include in mediation analyses when the proposed model and indirect effect(s) are informed by theory, as presented here (Hayes, 2013; Hayes & Scharkow, 2013), and if the effects of interest do not take time to unfold (Preacher & Kelly, 2011). Indeed, prior research on belief in free will suggests that, longitudinally speaking, people generally tend to believe in free will (Baumeister et al., 2009; Vohs & Baumeister, 2010). Thus, the processes between the constructs may be inherent in modern human

psychology. Furthermore, other research on the effects of belief in free will has also employed correlational designs (e.g., Feldman et al., 2016; Stillman et al., 2010; 2011).

Although these designs can be beneficial for exploratory studies that establish novel indirect effects between constructs, more evidence is required for causal relations (Baumeister & Brewer, 2012). Therefore, experimental and longitudinal replications of these studies that examine (latent) cross-lagged mediation models will provide greater support for the mediated relationship reported. Concurrently, we stress that the causal ordering of variables in our mediation models was theoretically informed, supplemented by using different materials across studies, and we found convergent results (Hayes, 2013). Accordingly, we tested whether the observed trait-level data were consistent with our theoretical model, which they were.

On this note, Feldman et al. (2016) recently found that belief in free will and trait self-control interacted, such that best performance among participants was achieved when both trait self-control and belief in free will were high. Feldman et al. (2016) interpret these results as suggesting that the exertion of self-control to control one's impulses requires the volitional choice to do so (e.g., free will; Baumeister, 2008a, 2008b) and the choice to exert control depends on the psychological resources to execute (Stillman et al., 2010). Thus, the belief in free will can be conceptualized as the freedom to choose the direction, whereas trait self-control facilitates the pursuit of this direction over time. Ultimately, Feldman et al.'s interpretation suggests that self-control may be more appropriate for these longitudinal studies, rather than free will belief per se (see also Crescioni et al., 2016).

6.3.2 Reciprocal relationships. In a similar context, we acknowledge that the relationships between the constructs in our theoretical model may have developed through evolution to become bi-directional. Social relationships may promote meaning in life and a stronger sense of meaning in life could also facilitate the formation of interpersonal

relationships. For example, Stillman, Lambert et al. (2011) showed that people who reported a stronger sense of meaning in life were more likely to be rated interpersonally appealing. Thus, people who have a strong sense of meaning in life may also facilitate the formation of interpersonal relationships.

Concurrently, Stillman, Lambert, et al. (2011) note that people may seek to affiliate with those who have a strong sense of meaning, presumably as a means of satisfying their own need for meaning, consistent with the ordering of variables in our proposed model. Again, many human needs are met in human relationships, including the need for meaning (Baumeister, 2005; Heine et al., 2006). Indeed, in both correlational and experimental data, the absence of interpersonal relationships has been associated with low levels of meaning (Stillman et al., 2009; Williams, 2002). Importantly, regarding our ordering of variables in our model, meaning frameworks are derived through these close relationships (Heine et al., 2006; Tomasello, 1999). That is, meaningfulness via feelings of belongingness may have developed over time that built on humanity's adapted biological strategy and increased cognitive capacities. In turn, meaning maintenance may have been a further development from our foundational model in conjunction with humanity's increased resources from interpersonal relationships.

In a similar context, as initiative, a basic form of free will, likely developed first in human psychology from which people began living in social groups (Baumeister et al., 2011), and as evolution modifies and extends these existing systems (Allman, 1999), we are confident in ordering free will belief before belongingness in our model. Specifically, Baumeister et al. (2011) contend that initially beliefs and psychological capacities emerged to improve survival and reproduction and that later adaptations built on these capacities in an increasingly social environment. Belief in free will would have helped people to restrain their impulses so as to gain acceptance and approval from groups, key factors that in turn would

promote feelings of belongingness (e.g., Baumeister, 2008b). Again, empirical evidence shows that belief in free will causally effects pro-social behavior that benefits, and may well maintain, belongingness to groups (e.g., Baumeister et al., 2009; Stillman & Baumeister, 2010b; Vohs & Schooler, 2008). These pro-social behaviors are dependent on limited self-regulatory resources (Baumeister et al., 2011; DeWall et al., 2008; DeWall et al., 2007), which seem to be enacted specifically to initiate and maintain belongingness (e.g., Baumeister et al., 2005; Twenge et al., 2001; Twenge et al., 2003). Indeed, physiological evidence demonstrated that belief in free will causally effects neurological responses involved in self-control (e.g., Rigoni, Kühn, Sartori, & Brass, 2011; Rigoni, Pourtois, & Brass, 2015). Simultaneously, we acknowledge that psychological beliefs, capacities, and sociality mutually evolved in later stages of humanity's evolution (Barchas, 1986). Nevertheless, free will beliefs, and its related psychological resources, would still be required to *maintain* and achieve feelings of belongingness long-term (Baumeister, 2008a, 2008b, Baumeister et al., 2011), consistent with the ordering of variables in our model. In summary, our results and reasoning represent a theoretically founded pathway that explains part of the relationship between free will beliefs, meaningfulness, and feelings of belongingness. Concurrently, reciprocal paths between the constructs may have developed later from this foundational model.

6.3.4 Meaning search. One area for future research is to examine the role of meaning search in our proposed model. Indeed, Crescioni et al. (2016) found that search for meaning, included as a composite with meaningfulness, correlated with free will belief. Although search for meaning was not investigated in our research, belief in free will may harness meaning search because of the former's links to goal setting (Crescioni et al., 2016). For example, in the context of our own research, it could be argued that belief in free will may facilitate meaning search if people seek belongingness specifically to fulfill their need for

meaningfulness (e.g., Heine et al., 2006; Stillman et al., 2009). On this note, it is important to state regarding our evolutionary theoretical framework that humanity's search for meaningfulness may have developed later when their cognitive capacities allowed this (e.g., Sedikides & Skowronski, 2003). Again, this is because meaning frameworks are derived through close relationships (Heine et al., 2006; Tomasello, 1999). That is, the search for meaningfulness may have developed over time that built on humanity's adapted biological strategy and increased cognitive capacities. In turn, search for meaning may have been a further development from our foundational model, although this contention is speculative and deserves further investigation.

6.3.5 Other mediators and moderators. Additionally, although the data presented suggests that the relationship between free will beliefs and meaningfulness via a sense of belongingness is robust, belief in free will's relationship with meaningfulness has other functions and mediators independent of feelings of belongingness (e.g., Crescioni et al., 2016). Indeed, one suggestion for future research on this topic would be to integrate the relationship between belief in free will and meaningfulness into one model through two paths: one in which free will belief facilitates pursuit of meaningful goals (e.g., Crescioni et al., 2016) and another to promote societal coexistence (Baumeister 2008a, 2008b). In a similar vein, other researchers have highlighted that the effects of belief in free will may be moderated (e.g., Baumeister, Bauer, & Lloyd, 2011). For example, some have suggested that different structures and powers in societies can constrain free will (e.g., socio-economic status; Mick, 2007). These factors would likely impede on social engagement. In addition, there is general agreement in the literature that exercising free will depends on a large supply of a limited mental resource (Gailliot et al., 2007) that is used only intermittently. Therefore, people are likely incompletely self-disciplined and exercise free will only for specific purposes and in certain settings (Baumeister, 2008a, 2008b; Baumeister et al., 2008; 2010).

Collectively, these points converge on the argument that belief in free will may promote meaningfulness through a sense of belongingness, only in specific circumstances and for certain functions.

7. Conclusion

Our findings corroborate previous research claiming that belief in free will has important societal implications (Baumeister et al., 2008; Vohs & Baumeister, 2010). In accordance with theories outlining the evolutionary function and roots of belief in free will (Baumeister, 2008a; Baumeister et al., 2008), our data conform to our reasoning that belief in free will enables people to control their anti-social impulses that promotes acceptance and feelings of belongingness (Baumeister, 2005, 2008b) that is ultimately a source of meaningfulness. Again, to our knowledge, no previous research has demonstrated this model or indeed the relationship between belief in free will and feelings of belongingness. Further tests of the model are recommended. We believe that the current studies illuminate how research on free will beliefs in conjunction with meaning-making processes offers a beneficial theoretical framework to interpret the effects of and develop research on beliefs in free will.

References

- Aarts, H., & Van den Bos, K. (2011). On the foundations of beliefs in free will: Intentional binding and unconscious priming in self-agency. *Psychological Science*, 22, 532–537. doi:10.1177/0956797611399294
- Allman, J. (1999). *Evolving brains*. New York, NY: Scientific American Library.
- Barchas, P. (1986). A sociophysiological orientation to small groups. In E. Lawler (Ed.), *Advances in group processes* (Vol. 3, pp. 209-246). Greenwich, CT: JAI Press.
- Baumeister, R. F. (2005). *The cultural animal: Human nature, meaning, and social life*. New York, NY: Oxford University Press.
- Baumeister, R. F. (2008a). Free will in scientific psychology. *Perspectives on Psychological Science*, 3, 14-19. doi:10.1111/j.1745-6916.2008.00057.x
- Baumeister, R. F. (2008b). Free will, consciousness and cultural animals. In J. Baer, J.C. Kaufman, & R.F. Baumeister (Eds.), *Are we free? Psychology and free will* (pp. 65–85). Oxford, UK: Oxford University Press.
- Baumeister, R. F., Bauer, I. M., & Lloyd, S. A. (2010). Choice, free will, and religion. *Psychology of Religion And Spirituality*, 2, 67-82. doi:10.1037/a0018455
- Baumeister, R. F., & Brewer, L. E. (2012). Believing versus disbelieving in free will: Correlates and consequences. *Social and Personality Psychology Compass*, 6, 736-745. doi:10.1111/j.1751-9004.2012.00458.x
- Baumeister, R. F., Crescioni, A. W., & Alquist, J. L. (2011). Free will as advanced action control for human social life and culture. *Neuroethics*, 4, 1-11. doi:10.1007/s12152-010-9058-4
- Baumeister, R. F., DeWall, C. N., Ciarocco, N. J., & Twenge, J. M. (2005). Social exclusion impairs self-regulation. *Journal of Personality and Social Psychology*, 88, 589–604. doi:10.1037/0022-3514.88.4.589

- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, 117, 497–529. doi:10.1037/0033-2909.117.3.497
- Baumeister, R. F., Masicampo, E. J., & DeWall, N. C. (2009). Prosocial benefits of feeling free: Disbelief in free will increases aggression and reduces helpfulness. *Personality and Social Psychology Bulletin*, 35, 260-268. doi:10.1177/0146167208327217
- Baumeister, R. F., Sparks, E. A., Stillman, T. F., & Vohs, K. D. (2008). Free will in consumer behavior: Self-control, ego-depletion, and choice. *Journal of Consumer Psychology*, 18, 4-13. doi:10.1016/j.jcps.2007.10.002
- Bergner, R. M., & Ramon, A. (2013). Some implications of beliefs in altruism, free will, and nonreductionism. *Journal of Social Psychology*, 153, 598-618. doi:10.1080/00224545.2013.798249
- Bertelsen, P. (2011). Intentional activity and free will concepts as core concepts in criminal law and psychology. *Theory and Psychology*, 22, 46-66. doi:10.1177/0959354310384759
- Cacioppo, J. T., Hawkley, L. C., & Berntson, G. C. (2003). The anatomy of loneliness. *Current Directions in Psychological Science*, 12, 71-74. doi:10.1111/1467-8721.01232
- Carver, C. S., & Scheier, M. F. (1982). Outcome expectancy, locus of attribution for expectancy, and self-directed attention as determinants of evaluations and performance. *Journal of Experimental Social Psychology*, 18, 184-200. doi:10.1016/0022-1031(82)90049-X
- Clark, C. J., Luguri, J. B., Ditto, P. H., Knobe, J. Shariff, A. F., & Baumeister, R. F. (2014). Free to punish: A motivated account of free will belief. *Journal of Personality and Social Psychology*, 106, 501-513. doi:10.1037/a0035880

Cohen, J. W. (1988). *Statistical power analysis for the behavioral sciences*. (2nd ed).

Hillsdale, New Jersey, NJ: Lawrence Erlbaum Associates.

Crescioni, A. W., Baumeister, R. F., Ainsworth, S. E., Ent, M., & Lambert, N. M. (2016).

Subjective correlates and consequences of belief in free will. *Philosophical Psychology*, 29, 41-63. doi:10.1080/09515089.2014.996285

DeWall, C. N., Baumeister, R. F., Gailliot, M. T., & Maner, J. K. (2008). Depletion makes

the heart grow less helpful: Helping as a function of self-regulatory energy and genetic relatedness. *Personality and Social Psychology Bulletin*, 34, 1653-1662. doi:10.1177/0146167208323981

DeWall, C. N., Baumeister, R. F., Stillman, T. F., & Gailliot, M. T. (2007). Violence restrained: Effects of self-regulatory capacity and its depletion on aggressive behavior. *Journal of Experimental Social Psychology*, 43, 62-76.

doi:10.1016/j.jesp.2005.12.005

DeWall, C. N., Twenge, J. M., Bushman, B., Im, C., & Williams, K. (2010). A little acceptance goes a long way: Applying social impact theory to the rejection-aggression link. *Social Psychological and Personality Science*, 1, 168-174.

doi:10.1177/1948550610361387

DeWall, C. N., Twenge, J. M., Gitter, S. A., & Baumeister, R. F. (2009). It's the thought that counts: The role of hostile cognition in shaping aggressive responses to social exclusion. *Journal of Personality and Social Psychology*, 96, 45-59.

doi:10.1037/a0013196

Feldman, G., Baumeister, R. F., & Wong, K. F. E. (2014). Free will is about choosing: The link between choice and belief in free will. *Journal of Experimental Social Psychology*, 55, 239-245. doi:10.1016/j.jesp.2014.07.012

- Feldman, G., Chandrashekar, S. P., & Wong, K. F. E. (2016). The freedom to excel: Belief in free will predicts better academic performance. *Personality and Individual Differences, 90*, 377-383. doi:10.1016/j.paid.2015.11.043
- Flanagan, O. J. (1996). *Self expressions: Mind, morals, and the meaning of life*. New York, NY: Oxford University Press.
- Gailliot, M. T., Baumeister, R. F., DeWall, C. N., Maner, J. K., Plant, E. A., Tice, D. M., ...Schmeichel, B.J. (2007). Self-control relies on glucose as a limited energy source: Willpower is more than a metaphor. *Journal of Personality and Social Psychology, 92*, 325-336. doi:10.1037/0022-3514.92.2.325
- Greenberg, J., Koole, S. L., & Pyszczynski, T. (2004). *Handbook of experimental existential psychology*. New York, NY: Guildford Press.
- Gordon, A. M., Impett, E. A., Kogan, A., Oveis, C., & Keltner, D. (2012). To have and to hold: Gratitude promotes relationship maintenance in intimate bonds. *Journal of Personality and Social Psychology, 103*, 257-274. doi:10.1037/a0028723
- Harmon-Jones, E., Greenberg, J., Solomon, S., & Simon, L. (1996). The effects of mortality salience on intergroup bias between minimal groups. *European Journal of Social Psychology, 26*, 677-681. doi:10.1002/(SICI)1099-0992(199607)26:4<677::AID-EJSP777>3.0.CO;2-2
- Hayes, A. F. (2012). PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling [White paper]. Retrieved from <http://www.afhayes.com/public/process2012.pdf>
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guildford Press.

- Hayes, A. F., & Scharkow, M. (2013). The relative trustworthiness of inferential tests of the indirect effect in statistical mediation analysis: Does method really matter? *Psychological Science*, 24, 1918-1927. doi:10.1177/0956797613480187
- Heine, S. J., Proulx, T., & Vohs, K. D. (2006). The meaning maintenance model: On the coherence of social motivations. *Personality and Social Psychology Review*, 10, 88-110. doi:10.1207/s15327957pspr1002_1
- Lynn, M. T., Muhle-Karbe, P. S., Aarts, H., & Brass, M. (2014). Priming determinist beliefs diminishes implicit (but not explicit) components of self-agency. *Frontiers in Psychology*, 6: 369. doi:10.3389/fpsyg.2014.01483
- MacKenzie, M. J., Vohs, K. D., & Baumeister, R. F. (2014). You didn't have to do that: Belief in free will promotes gratitude. *Personality and Social Psychology Bulletin*, 40, 1423-1434, doi:10.1177/0146167214549322
- Malone, J.P., Pillow, D.R., Osman, A. (2012). The general belongingness scale (GBS): Assessing achieved belongingness. *Personality and Individual Differences*, 52, 311-316. doi:10.1016/j.paid.2011.10.027
- Mick, D. G. (2007). Degrees of freedom of will: An essential endless question in human behavior. *Journal of Consumer Psychology*, 18, 17-21. doi:10.1016/j.jcps.2007.10.004
- Monroe, A. E., & Malle, B. F. (2010). From uncaused will to conscious choice: The need to study, not speculate about people's folk concept of free will. *Review of Philosophy and Psychology*, 9, 211-224. doi:10.1007/s13164-009-0010-7
- Nahmias, E., Morris, S., Nadelhoffer, T., & Turner, J. (2005). Surveying freedom: Folk intuitions about free will and moral responsibility. *Philosophical Psychology*, 18, 561-584. doi:10.1080/09515080500264180

- Paulhus, D. L., & Carey, J. M. (2011). The FAD-plus: Measuring lay beliefs regarding free will and related constructs. *Journal of Personality Assessment*, 93, 96-104.
doi:10.1080/00223891.2010.528483
- Preacher, K. J., & Kelly, K. (2011). Effect size measures for mediation models: Quantitative strategies for communicating indirect effects. *Psychological Methods*, 16, 93-115.
doi:10.1037/a0022658
- Putnam, R. D. (2000). *Bowling alone: The collapse and revival of American community*. New York, NY: Simon & Schuster.
- Rakos, R.F., Laurene, K.R., Skala, S., & Slane, S. (2008). Belief in free will: Measurement and conceptualization innovations. *Behavior and Social Issues*, 17, 20-39.
doi:10.5210/bsi.v17i1.1929
- Rigoni, D., Kühn, S., Gaudino, G., Sartori, G., & Brass, M. (2012). Reducing self-control by weakening belief in free will. *Consciousness and Cognition*, 21, 1482-1490.
doi:10.1016/j.concog.2012.04.004
- Rigoni, D., Kühn, S., Sartori, G., & Brass, M. (2011). Inducing disbelief in free will alters brain correlates of preconscious motor preparation: The brain minds whether we believe in free will or not. *Psychological Science*, 22, 613-618.
doi:10.1177/0956797611405680
- Rigoni, D., Pourtois, G., & Brass, M. (2015). 'Why should I care?' Challenging free will attenuates neural reaction to errors. *Social Cognitive and Affective Neuroscience*, 10, 262-268. doi:10.1093/scan/nsu068
- Russell, D. W. (1996). UCLA loneliness scale (version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment*, 66, 20-40.
doi:10.1207/s15327752jpa6601_2

- Russell, D., Peplau, L. A., & Cutrona, C. E. (1980). The revised UCLA loneliness scale: Concurrent and discriminant validity evidence. *Journal of Personality and Social Psychology*, 39, 472-480. doi:10.1037/0022-3514.39.3.472
- Sarkissian, H., Chatterjee, A., De Brigard, F., Knobe, J., Nichols, S., & Sirker, S. (2010). Is belief in free will a cultural universal? *Mind & Language*, 25, 346-358. doi:10.1111/j.1468-0017.2010.01393.x
- Sedikides, C., & Skowronski, J. J. (2003). Evolution of the self: Issues and prospects. In M. R. Leary & J. P. Tangney (Eds.), *Handbook of self and identity* (pp. 594–609). New York, NY: Guilford.
- Seto, E., Hicks, J. A., Davis, W. E., & Smallman, R. (2014). Free will, counterfactual reflection, and the meaningfulness of life events. *Social Psychological and Personality Science*, 6, 243-250. doi:10.1177/1948550614559603
- Shariff, A. F., Greene, J. D., Karremans, J. C., Luguri, J. B., Clark, C. J., Schooler, J. W., Baumeister, R. F., & Vohs, K. D. (2014). Free will and punishment: A mechanistic view of human nature reduces retribution. *Psychological Science*, 25, 1-8. doi:10.1177/0956797614534693
- Shariff, A. F., Schooler, J., & Vohs, K. D. (2008). The hazards of claiming to have solved the hard problem of free will. In J. Baer, J.C. Kaufman, & R.F. Baumeister (Eds.), *Are we free? Psychology and free will* (pp. 181–204). Oxford, UK: Oxford University Press.
- Siu, A. H., Cheng, H. H., & Leung, M. M. (2006). Prosocial norms as a positive youth development construct: Conceptual bases and implications for curriculum development. *International Journal of Adolescent Medicine And Health*, 18, 451-457. doi:10.1515/IJAMH.2006.18.3.451

- Steger, M. F., Frazier, P., Oishi, S., & Kaler, M. (2006). The meaning in life questionnaire: Assessing the presence of and search for meaning in life. *Journal of Counseling Psychology, 53*, 80-93. doi:10.1037/0022-0167.53.1.80
- Stillman, T. F., & Baumeister, R. F. (2010a). Free will in everyday life: Autobiographical accounts of free and unfree actions. *Philosophical Psychology, 24*, 381-394. doi: 10.1080/09515089.2011.556607
- Stillman, T. F., & Baumeister, R. F. (2010b). Guilty, free, and wise: Determinism and psychopathy diminish learning from negative emotions. *Journal of Experimental Social Psychology, 46*, 951-960. doi: 10.1016/j.jesp.2010.05.012
- Stillman, T. F., Baumeister, R. F., Lambert, N. M., Crescioni, A. W., DeWall, C. N., & Fincham, F.D. (2009). Alone and without purpose: Life loses meaning following social exclusion. *Journal of Experimental Social Psychology, 45*, 686-694. doi:10.1016/j.jesp.2009.03.007
- Stillman, T. F., Baumeister, R. F., & Mele, A. R. (2011). Free will in everyday life: Autobiographical accounts of free and unfree actions. *Philosophical Psychology, 24*, 381-394. doi:10.1080/09515089.2011.556607
- Stillman, T. F., Baumeister, R. F., Vohs, K. D., Lambert, N. M., Fincham, F. D., & Brewer, L. E. (2010). Personal philosophy and personnel achievement: Belief in free will predicts better job performance. *Social Psychological and Personality Science, 1*, 43-50. doi:10.1177/1948550609351600
- Stillman, T. F., Lambert, N. M., Fincham, F. D., & Baumeister, R. F. (2011). Meaning as magnetic force: Evidence that meaning in life promotes interpersonal appeal. *Social Psychological and Personality Science, 2*, 13-20. doi: 10.1177/1948550610378382
- Tabachnick, B. G., & Fidell, L. S. (2013) *Using multivariate statistics. (6th Ed.)*. Boston, MA: Pearson.

Tomasello, M. (1999). *The cultural origins of human cognition*. Cambridge, MA: Harvard University Press.

Twenge, J. M., Baumeister, R. F., Tice, D. M., & Stucke, T. S. (2001). If you can't join them, beat them: Effects of social exclusion on aggressive behavior. *Journal of Personality and Social Psychology*, 81, 1058-1069. doi:10.1037//0022-3514.81.6.1058

Twenge, J. M., Catanese, K. R., & Baumeister, R. F. (2002). Social exclusion causes self-defeating behavior. *Journal of Personality and Social Psychology*, 83, 606-615. doi: 10.1037//0022-3514.83.3.606

Twenge, J. M., Catanese, K. R., & Baumeister, R. F. (2003). Social exclusion and the deconstructed state: Time perception, meaninglessness, lethargy, lack of emotion, and self-awareness. *Journal of Personality and Social Psychology*, 85, 409-423. doi: 10.1037/0022-3514.85.3.409

Van Tilburg, W. A. P., & Igou, E. R. (2011). On boredom and social identity: A pragmatic meaning-regulation approach. *Personality and Social Psychology Bulletin*, 37, 1679-1691. doi:10.1177/0146167211418530

Van Tilburg, W. A. P., & Igou, E. R. (2013). On the meaningfulness of behavior: An expectancy x value approach. *Motivation and Emotion*, 37, 373-388. doi:10.1007/s11031-012-9316-3

Vohs, K. D., & Baumeister, R. F. (2010). Addiction and free will. *Addiction Research and Theory*, 17, 231-235. doi: 10.1080/16066350802567103

Vohs, K. D., & Schooler, J. W. (2008). The value of believing in free will: Encouraging a belief in determinism increases cheating. *Psychological Science*, 19, 49-54. doi:10.1111/j.1467-9280.2008.02045.x

- Wegner, D. M., & Wheatley, T. P. (1999). Apparent mental causation: Sources of the experience of will. *American Psychologist*, 54, 480–492. doi:10.1037/0003-066X.54.7.480
- Wegner, D. M. (2003). The mind's best trick: How we experience conscious will. *Trends in Cognitive Science*, 7, 65–69. doi:10.1016/S1364-6613(03)00002-0
- Wegner, D. M. (2005). Who is the controller of the controlled processes? In R. R. Hassin, J.S. Uleman, J. A. Bargh (Eds.). *The New Unconscious* (pp. 19-36). New York, NY: Oxford University Press.
- Williams, K. D. (2002). *Ostracism: The power of silence*. New York, NY: Guilford Press.
- Zadro, L., Williams, K. D., & Richardson, R. (2004). How low can you go? Ostracism by computer is sufficient to lower self-reported belonging, control, self-esteem, and meaningful existence. *Journal of Experimental Social Psychology*, 40, 560-567. doi:10.1016/j.jesp.2003.11.006
- Zhou, X., Sedikides, C., Wildschut, T., & Gao, D. (2008). Counteracting loneliness: On the restorative function of nostalgia. *Psychological Science*, 19, 1023-1029. doi:10.1111/j.1467-9280.2008.02194.x

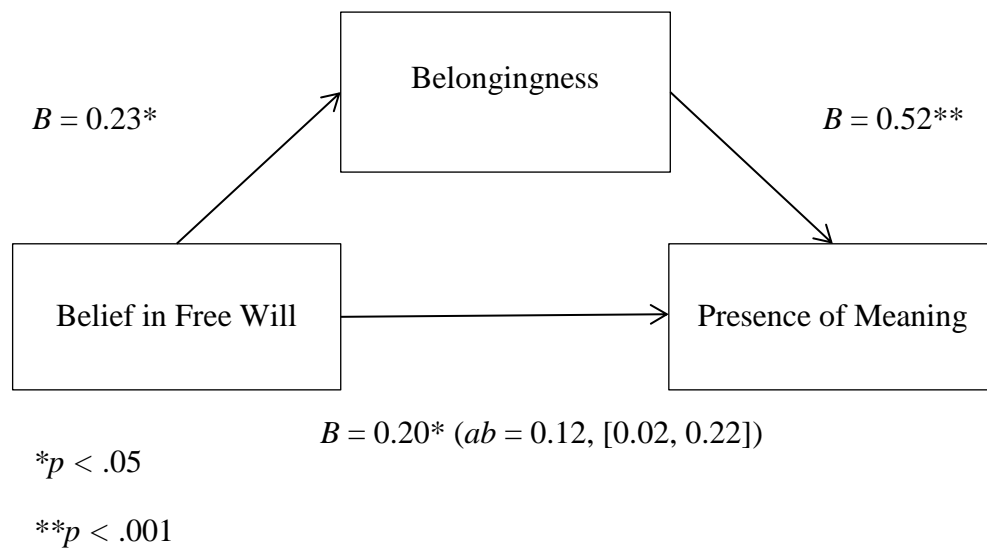
Figure 1: *Conceptual Representation of the Mediation Model (Study 1)*

Figure 1: An outline of the relationship between belief in free will and presence of meaning, significantly mediated by feelings of belongingness.

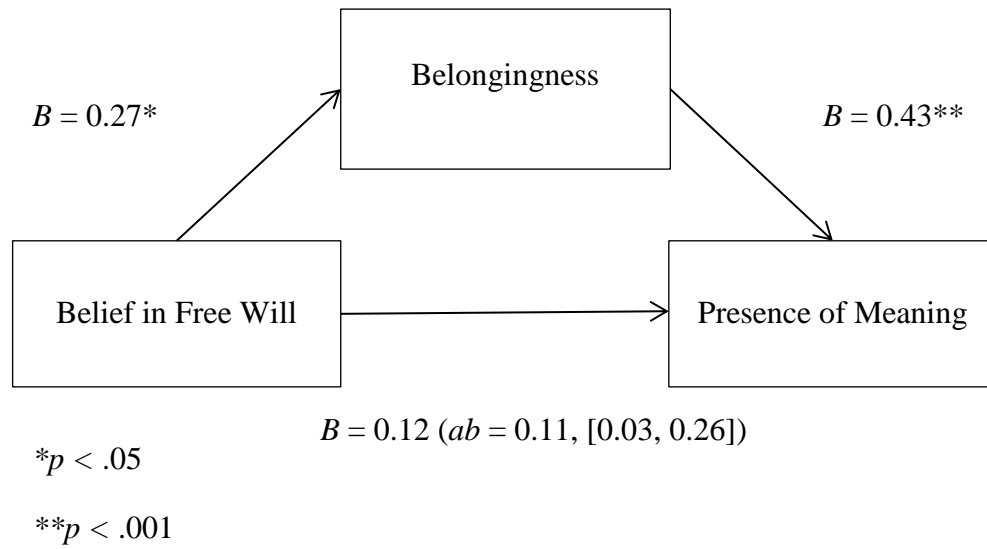
Figure 2: *Conceptual Representation of the Mediation Model (Study 2)*

Figure 2: An outline of the relationship between belief in free will and presence of meaning, significantly mediated by feelings of belongingness.

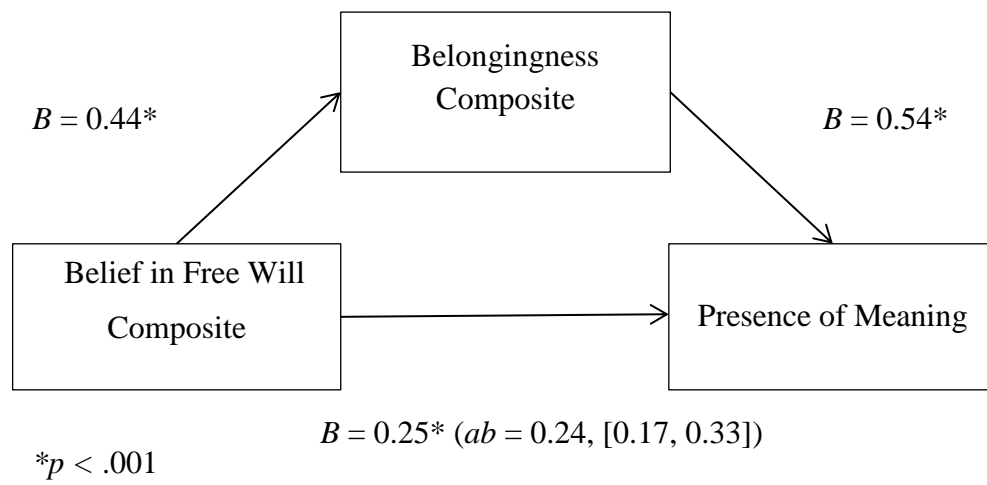
Figure 3: *Conceptual Representation of the Mediation Model (Study 3)*

Figure 3: An outline of the relationship between the belief in free will composite and presence of meaning, significantly mediated by a composite measure of feelings of belongingness.

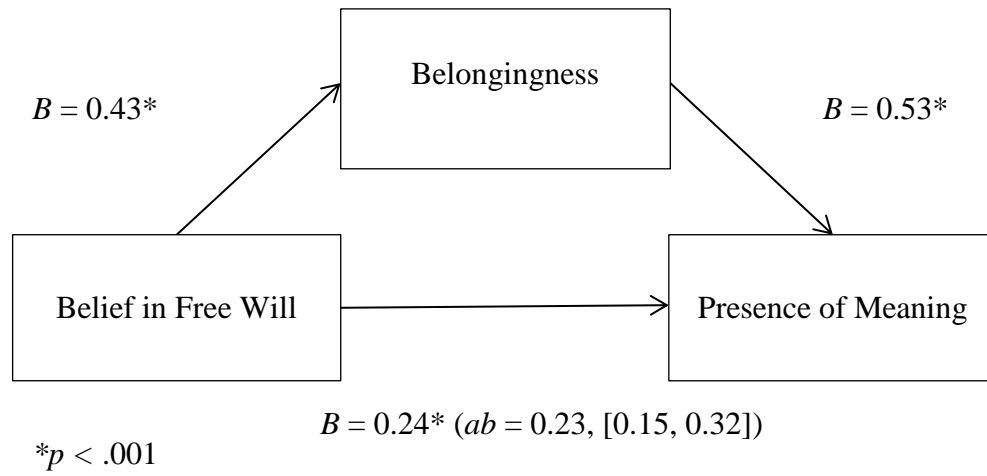
Figure 4: *Conceptual Representation of the Mediation Model (Study 3)*

Figure 4: An outline of the relationship between belief in free will and presence of meaning, significantly mediated by feelings of belongingness, replicating Study 1.

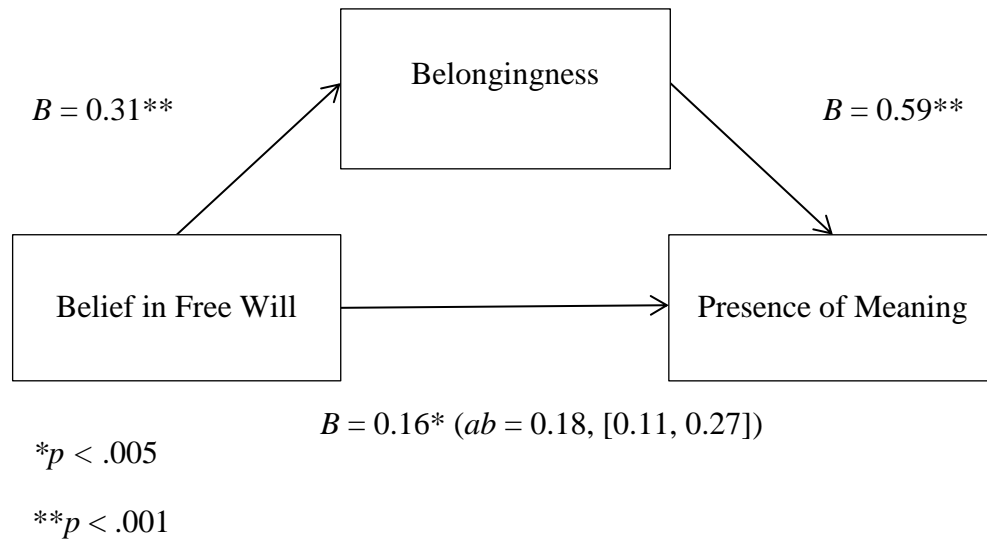
Figure 5: *Conceptual Representation of the Mediation Model (Study 3)*

Figure 5: An outline of the relationship between belief in free will and presence of meaning, significantly mediated by feelings of belongingness, replicating Study 2.

Figure 6: *Forest Plot Including Correlations Between Free Will Beliefs and Meaningfulness (Studies 1-3)*

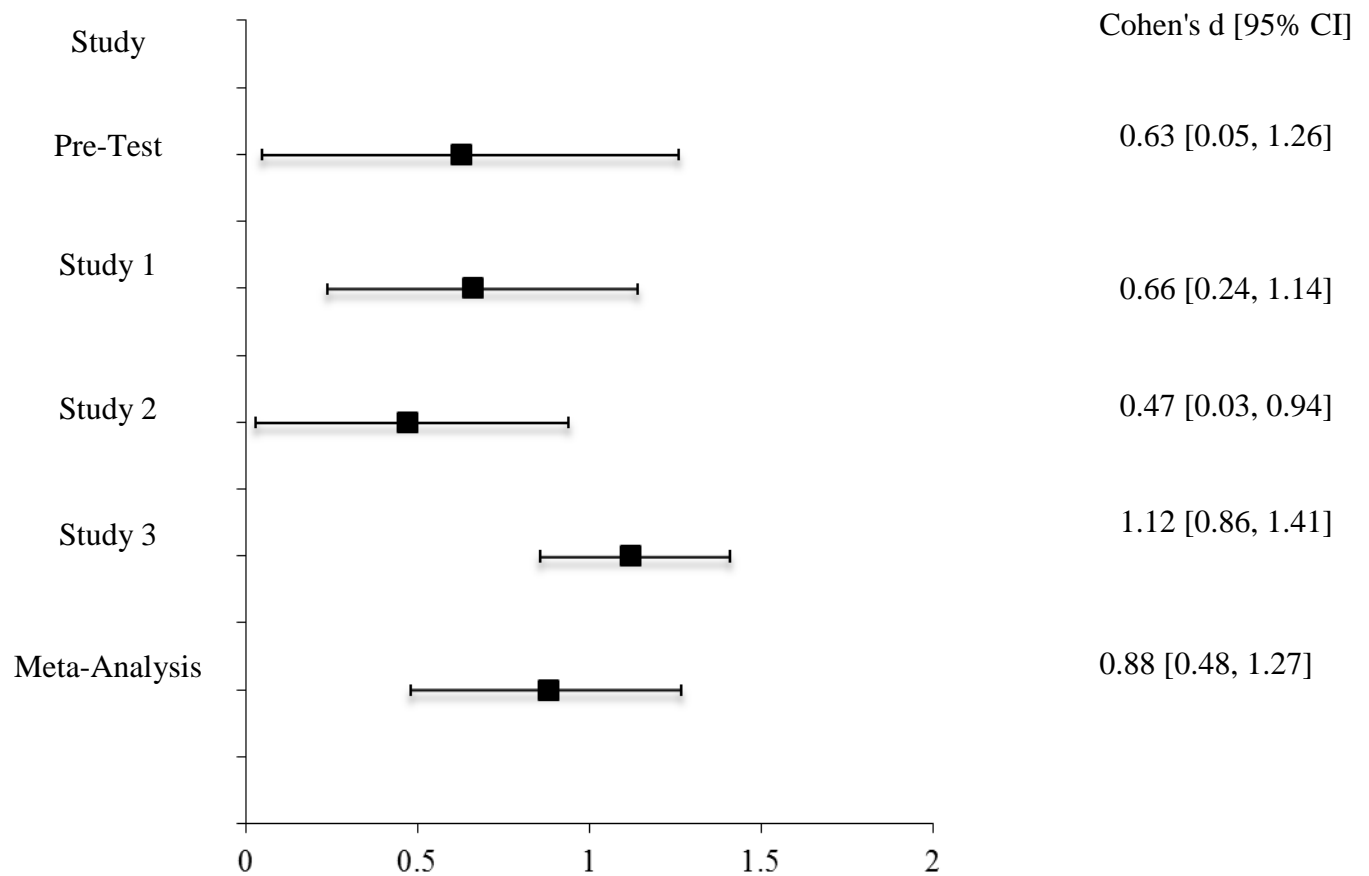


Figure 6: An outline of the significant relationship between free will beliefs and meaningfulness across the studies.

Figure 7: *Forest Plot Including Correlations Between Free Will Beliefs and Feelings of Belongingness (Studies 1-3)*

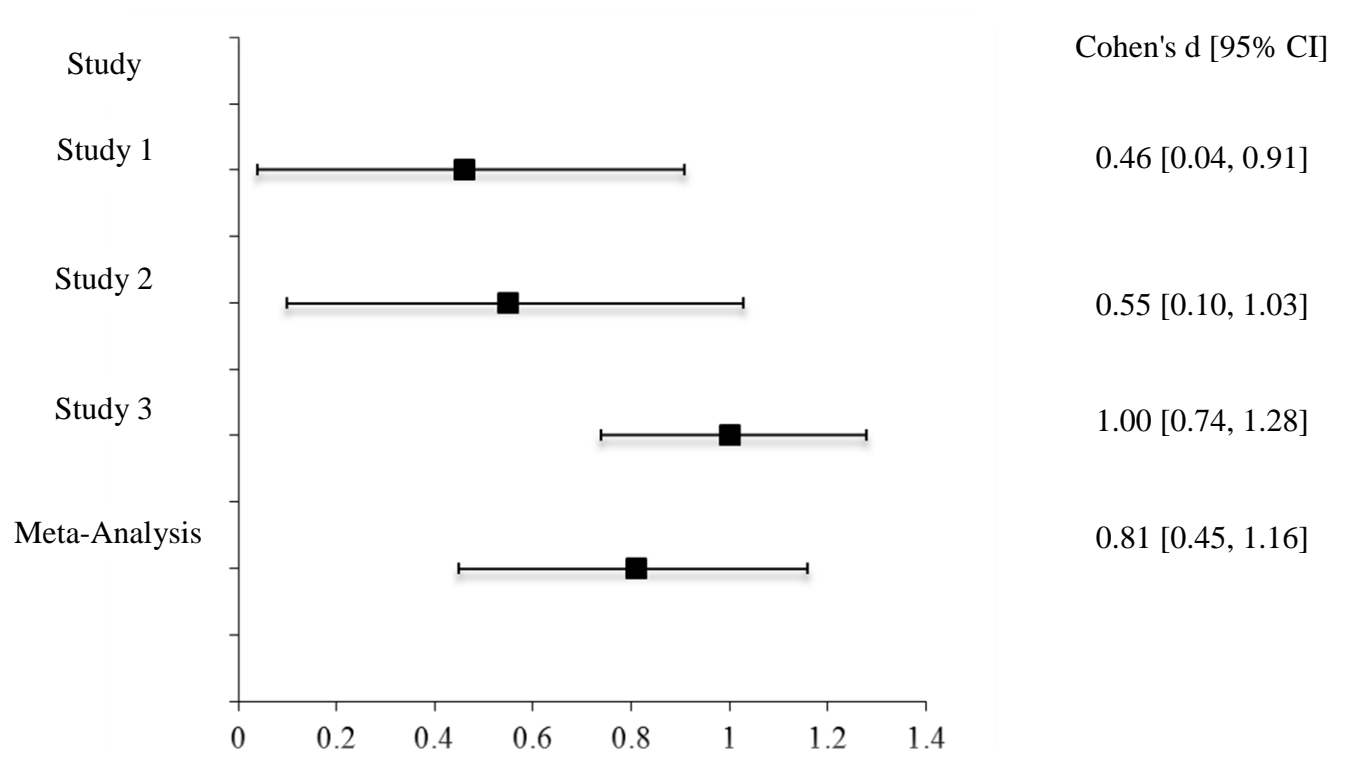


Figure 7: An outline of the significant relationship between belief in free will and feelings of belongingness across the studies.

Figure 8: *Forest Plot Including Correlations Between Meaningfulness and Feelings of Belongingness (Studies 1-3)*

Study	Cohen's d [95% CI]
Study 1	1.35 [0.87, 1.89]
Study 2	1.04 [0.56, 1.57]
Study 3	1.71 [1.41, 2.04]
Meta-Analysis	1.51 [1.12, 1.95]

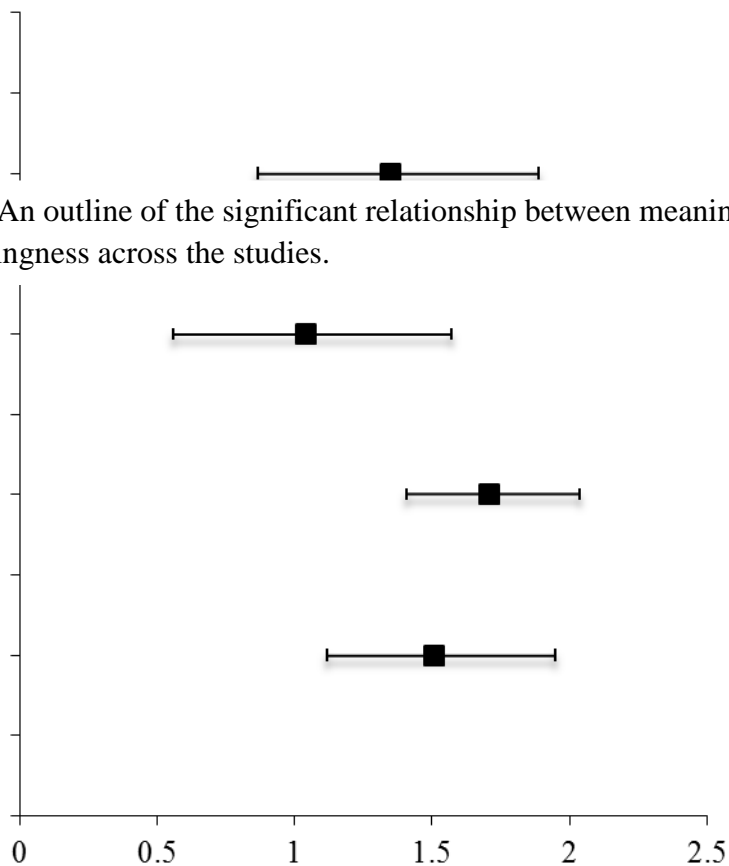


Figure 8: An outline of the significant relationship between meaningfulness and feelings of belongingness across the studies.

