

**More Than a Momentary Blip in the Universe? Investigating the Link between  
Religiousness and Perceived Meaning in Life**

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## Abstract

One longitudinal and four cross-sectional studies (total  $N = 3,141$ ) tested two candidate explanations for the association between religiousness and perceived meaning in life. Religiousness may foster a sense of significance, importance, or mattering—either to others (social mattering) or in the grand scheme of the universe (cosmic mattering)—which in turn support perceived meaning. We found that perceived social mattering mediated, but could not fully explain, the link between religiousness and perceived meaning. In contrast, perceived cosmic mattering did fully explain the association. Overall, results suggest that perceived social and cosmic mattering are each part of the explanation. Yet, perceived cosmic mattering appears to be the stronger mechanism. We discuss how religious faith may be especially suited to support such perceptions, making it a partially unique source of felt meaning.

*Keywords:* mattering; meaning in life; positive psychology; religion; social integration; well-being

## **More Than a Momentary Blip in the Universe? Investigating the Link between Religiousness and Perceived Meaning in Life**

“Religion offers us a cure for the plague of loneliness... [It] also satisfies another, even deeper human need—perhaps the most fundamental human need of all. That is the need to know that somehow we matter, that our lives mean something, count as something more than just a momentary blip in the universe.” (Kushner, 1987, p. 93)

Rabbi Kushner’s claim that religious faith supports individuals’ perceptions of meaning in their lives is well-supported. Past research has found that Catholic nuns find their lives more meaningful than people who are not members of a religious order (Crumbaugh et al., 1970;  $N = 56$ ), and atheists experience less meaning than theists (Nelson et al., 2021;  $N = 404$ ). Continuous measures of religiousness correlate with perceived meaning in life, both cross-sectionally (Chamberlain & Zika, 1988 [ $N = 188$ ]; Hicks & King, 2008 [ $N = 253$ ]; Van Tongeren et al., 2013 [ $N = 423$ ]), and longitudinally (Krause & Hayward, 2012 [ $N = 1,011$ ]; Steger & Frazier, 2005 [ $N = 89$ ]). A 2-week experience sampling study ( $N = 3,048$ ) found that perceived presence of the divine tended to co-occur with and predict subsequent perceptions of meaning (Kucinkas et al., 2018).

Religiousness is also associated with the “need for meaning”—i.e., the degree to which one would be distressed by a perceived absence of meaning (Abeyta & Routledge, 2018; total  $N = 881$ ). A randomized experiment ( $N = 281$ ) found that participants who read an essay arguing that life is meaningless reported significantly greater belief in miracles than

participants who read about computers (Routledge et al., 2017). Another series of randomized experiments (total  $N = 362$ ) used non-conscious priming to achieve a similar effect (Van Tongeren & Green, 2010). Participants primed with words related to meaninglessness (e.g., futile, insignificant, trivial) reported greater religiousness than participants primed with matched, neutral words (e.g., furnace, invitational, trinket). These results suggest that, when experiencing threats to their sense of meaning, people may turn to religion for support. But how exactly does religion help satisfy the need for meaning? In this paper, we investigate two candidate explanations.

### Candidate Explanations

Some researchers (L. S. George & Park, 2016; Martela & Steger, 2016) argue that the judgment that one's life is meaningful is comprised of three distinct but related perceptions: comprehension or coherence (i.e., life makes sense); purpose (i.e., life has goals or direction); and significance or mattering (i.e., life has value and importance). This "tripartite" model of perceived meaning in life has only been empirically tested by one pair of researchers, and it did not fare well. In one cross-sectional and two longitudinal studies, employing samples of undergraduates as well as multinational adults (total  $N = 924$ ), Costin and Vignoles (2020) separately assessed meaning in life judgments and perceptions of coherence, purpose, and mattering. They found that, of these supposed facets, only perceived mattering consistently predicted meaning in life judgments. Although coherence and purpose may still be relevant, these findings support a focus on perceived mattering when attempting to explain the link between religiousness and perceived meaning in life.

There are different ways in which a person could feel that they matter. For instance, one might feel that one matters to other people—that one is “an object of another’s concern, interest, or attention” (Rosenberg & McCullough, 1981, p. 163). This construct is related to but distinct from belonging, which in psychological research is defined in terms of maintaining “strong, stable interpersonal relationships” (Baumeister & Leary, 1995, p. 497). Although such relationships typically support a sense of value and importance to others, they are conceptually distinct. Perceived social mattering is also conceptually similar to the “sociometer” theory of self-esteem, according to which self-esteem is “the output of a system that monitors and responds to interpersonal acceptance and rejection” (Leary, 2012, p. 141). However, a person might be accepted by others without being especially significant or important to them.

Individuals can also feel that they matter, not *to someone*, but in the grand scheme of things (L. S. George & Park, 2014). The observable universe is approximately 93 billion light years in diameter, 14 billion years old, and contains hundreds of billions of galaxies (van den Bergh, 1981). Against that cosmic backdrop, many consider humanity to be insignificant (Benatar, 2017; Nagel, 1971). Nevertheless, people don’t want to be mere momentary blips in a vast universe. Researchers across disciplines have argued that people crave “cosmic specialness” (Becker, 1973) or “cosmic meaning” (Yalom, 1980); that they want their lives to “be part of grand and important developments” (Baumeister, 1991, p. 61). This may explain why reminding people of the enormity of the universe can reduce perceived meaning in life (Routledge et al., 2017). “Cosmic mattering” constitutes the grandest possible form of mattering. It is importance or significance in the largest possible context. Hence, perceived

cosmic mattering, if it can be achieved, may be an especially potent source of perceived meaningfulness.

Religious faith could plausibly support perceptions of both social and cosmic mattering. Religions often act as social glue, bringing people into communities (Graham & Haidt, 2010; Van Cappellen et al., 2017). The social resources that can come from involvement in religious community have long been argued to explain why religiousness is associated with positive outcomes (Ellison & George, 1994; L. K. George et al., 2002; Hayward & Krause, 2013). Moreover, past research has found religiousness to be positively associated with perceived social mattering (total  $N = 1,958$ ; Lewis & Taylor, 2009; Schieman et al., 2010), suggesting that one route from religion to perceived meaning in life may be through the sense of social significance that arises from religious community.

Religion may also support a sense of cosmic mattering. Cultural anthropologist, Ernest Becker, argued (1973) that religion gives people a sense of significance in a vast universe by connecting them with an infinite being (e.g., God). Most, if not all, religious faiths come with a cosmology (Halvorson & Kragh, 2019), a story about the origins and/or purpose of the universe. Often, these cosmologies give humanity a central role, claiming that humans have a relationship with a higher power, their lives are part of a grand plan, or even that the universe was “designed with you in mind” (Cook, 2021). In scientific cosmology, on the other hand, humanity has no central role (Weinberg, 2008). Humans are evolved organisms, propagating their genes on an infinitesimal speck of a planet. Hence, religious individuals have a clear advantage when it comes to feeling cosmically significant.

In short, we have identified two plausible explanations for the association between religiousness and perceived meaning in life: the Social Mattering Hypothesis (i.e.,

religiousness makes life feel meaningful by supporting perceived significance to others), and the Cosmic Mattering Hypothesis (i.e., religiousness makes life feel meaningful by supporting perceived significance in the universe).

We tested these explanations in five studies, assessing relative contributions when possible. We first confirmed that religiousness and perceived meaning in life are positively associated—both between individuals, and over time within an individual’s life (Study 1). As a preliminary test of the Social Mattering Hypothesis, we examined whether such links are mediated by a sense of social integration. We then (in Studies 2-3) tested whether perceived social mattering specifically mediates the between-persons link between religiousness and perceived meaning. Finally, we tested whether perceived cosmic mattering also mediates this link (Studies 4-5). Studies 4-5 also allowed us to compare the magnitude of the indirect paths. Table 1 summarizes the recruitment methods, sample sizes, and constructs measured in each of the 5 studies. Data, materials, and analytic code are available online: <https://osf.io/uwyr3/>. These studies were designed for other purposes. Hence, the sample sizes were not determined a priori to address the present questions. However, each study had greater than 98% power to detect the previously observed association between religiousness and perceived meaning in life, even using a conservative estimate ( $r = .25$ ; in the papers cited above,  $r$ s ranged from .28 to .47). We also ran “partial” post-hoc power analyses (Dziak et al., 2020) to determine the smallest effect sizes that our models were powered to detect. Results indicated that all studies were adequately powered to detect even small effects (for details, see the Supplemental Materials).

**Table 1. Summary of Recruitment Methods, Sample Sizes, and Constructs Across Studies**

Study	Recruitment Method	N	Measures of Key Constructs			
			<i>Religiousness</i>	<i>Perceived Meaning in Life</i>	<i>Perceived Social Mattering</i>	<i>Perceived Cosmic Mattering</i>
1	Community advertisements	227	<i>Nightly</i> : “I felt God’s presence” <i>Quarterly</i> : 5-item scale based on Saroglou & Muñoz-García 2008; Idler et al. 2003	<i>Nightly</i> : “I had a sense of meaning and purpose in life” <i>Quarterly</i> : 4-item scale from Hicks & King 2007		
2	Mailed surveys	1,501	4 items (importance of religion, public and solitary religious practices)	Meaning in Life Questionnaire – Presence (abbreviated)	General Mattering Scale	
3	Amazon’s Mechanical Turk	479	Duke Religion Index	Meaning in Life Questionnaire – Presence	General Mattering Scale	
4	Amazon’s Mechanical Turk	295	Duke Religion Index	Perceived Personal Meaning Scale	PIMQ	PCMQ
5 <i>Sample 1</i>	Undergraduate participant pool	252	“To what extent do you consider yourself a religious person?”	Perceived Personal Meaning Scale	PCOMQ; PSMQ	PCMQ – Short Form
5 <i>Sample 2</i>	Amazon’s Mechanical Turk	387	“To what extent do you consider yourself a religious person?”	Perceived Personal Meaning Scale	PCOMQ; PSMQ	PCMQ – Short Form

*Note.* In Study 1, participants completed shorter reports on a nightly basis for an 11-week period, and longer reports on a quarterly basis for 18 months (7 total). PIMQ indicates the Perceived Interpersonal Mattering Questionnaire. PCMQ indicates the Perceived Cosmic Mattering Questionnaire. PCOMQ indicates the Perceived Close Others Mattering Questionnaire. PSMQ indicates the Perceived Societal Mattering Questionnaire.



## Study 1

Data for this study were collected as a part of an experiment on the effects of meditation practices on emotions and health-related outcomes. Midlife adults **were randomly assigned either to learn mindfulness or loving-kindness meditation and** completed nightly reports for 11 weeks and quarterly reports for 18 months. Further details regarding this experiment are published elsewhere (Fredrickson et al., 2017; Rice & Fredrickson, 2017). **Although we tested for effects of experimental condition, these are not a focus of the present analyses.**

### Method

**Participants.** Participants were recruited in waves using email listservs and community advertisements between the summer of 2013 and fall of 2014. Participants were required to be between 35 and 64 years old, interested in making healthy lifestyle changes, and new to meditation. The initial sample included 231 participants. Of these,  $N = 227$  participants completed 1,241 quarterly reports and **13,231 nightly reports** ( $M_{age} = 48.58$ ,  $SD_{age} = 8.86$ ; 60.8% female, 37.9% male, 1.3% other or declined to answer; 4.8% Asian, 16.7% Black or African American, 76.7% White or Caucasian, 1.8% other or declined to answer; 11.0% Catholic Christian, 41.0% Protestant Christian, 1.3% Jewish, < 1% Muslim, < 1% Buddhist, 17.6% agnostic, 7.0% atheist, 20.7% other or declined to answer).

**Measures.** In the nightly reports, participants were asked to indicate how often (0 = “Never”, 4 = “Always”) they had certain experiences in the previous 24 hours. The items included: “I had a sense of meaning and purpose in life”, and “I felt God’s presence.” Participants also used a Likert scale (1 = “Not at all”, 7 = “Completely”) to answer: “In the

past 24 hours, how much did you feel socially integrated or ‘on the same page’ with others?” We used these as measures of perceived meaning, religiousness, and social integration, respectively.

In the quarterly reports, we assessed religiousness using five items (selected prior to data collection) that assessed three facets of the construct. Two items assessed “intrinsic religiousness” (Saroglou & Muñoz-García, 2008). Participants indicated their agreement (1 = “Not at all”, 7 = “Completely”) with “Religion is important in my life”, and “God is important in my life.” Three items assessed participation in public religious activities and solitary religious practices (Idler et al., 2003). Participants indicated the frequency with which they “attend religious services” (0 = “Never”, 8 = “Several times a week”), “take part in the activities of a place of worship other than attending services” (0 = “Never”, 10 = “Several times a day”), and “pray privately in places other than at a church/synagogue/temple” (0 = “Never”, 7 = “More than once a day”). Given the different response scales, we standardized each item across timepoints before averaging the five items. At each timepoint, the measure demonstrated good internal reliability (standardized coefficient  $\alpha \geq .88$ ).

In the quarterly reports, we assessed perceived meaning in life using a 4-item measure developed by Hicks and King (2007). Participants indicated the extent to which (1 = “Not at all”, 7 = “Extremely”) four statements were true of them (sample item: “My personal existence is very purposeful and meaningful”). This scale demonstrated excellent internal reliability at all timepoints (coefficient  $\alpha \geq .94$ ).

In the quarterly reports, we assessed perceived social integration using two negatively worded items from the UCLA Loneliness Scale (Russell, 1996): “How often do you feel that you are ‘in tune’ with the people around you?”; and “How often do you feel close to people?”

Following a previous study (Kok & Fredrickson, 2010), these items were selected (prior to data collection) to assess feelings of connectedness and to minimize participant burden for repeated measures. This scale demonstrated adequate internal reliability at all timepoints (coefficient  $\alpha \geq .73$ ).

**Analytic Plan.** We first tested for within- and between-person associations between religiousness and perceived meaning in life as well as social integration. We used the *lme4* and *lmerTest* packages in R (Bates et al., 2015; Kuznetsova et al., 2017) to run multilevel models with repeated measures nested within participants, allowing for random intercepts and slopes. For each predictor, we calculated grand mean-centered person means and deviations from person means (subtracting person means from corresponding individual observations). Including both of these as predictors in the model allows, respectively, for the estimation of between- and within-person associations (Curran & Bauer, 2011). We computed standardized coefficients using the “standardize\_parameters” function in the *effectsize* package (Ben-Shachar et al., 2020).

We then tested whether social integration mediates within- and between-person links between religiousness and perceived meaning in life. We ran multilevel structural equation models with robust (Huber-White) standard errors using the *lavaan* package in R (Rosseel, 2012). To temporally separate the predictor, mediator, and outcome, we time-lagged religiousness and social integration at the within-person level. Religiousness at time  $t$  predicted perceived meaning at  $t + 2$ , both directly and indirectly through social integration at  $t + 1$ . We also included social integration and perceived meaning in life at  $t$  as predictors,

respectively, of social integration at  $t + 1$  and perceived meaning in life at  $t + 2$ .<sup>1</sup> Hence, religiousness predicted subsequent *changes* in perceived meaning in life both directly and indirectly via *changes* in social integration during the intervening period. These models were saturated (i.e., zero remaining degrees of freedom). Hence, fit indices were not available. The mean-centering approach described above is not recommended for multilevel structural equation models (Preacher et al., 2011, p. 210). Hence, we used the raw variables in these models (grand mean-centering all Level 1 variables produced an identical pattern of results).

In all analyses, we compared the pattern of results while including versus excluding terms for main effects of, and interactions with, experimental condition. There were eight models in total: six multilevel regressions (three each for the nightly and quarterly data, testing for links between religiousness, perceived meaning, and social integration), and two multilevel mediation models (one each for the nightly and quarterly data). None showed a significant effect of condition and only one showed a significant interaction. For that exceptional case, we report the results while including the main effect and interaction terms. However, for parsimony, we report the other models (where the overall pattern of results was identical) without these terms. Results for models including these terms are available in the Supplemental Materials (see Table S1 for the results of multilevel regressions and Figure S1 for the results of multilevel mediation models).

## **Results**

Table 2 provides descriptive statistics and correlations for the nightly reports and quarterly reports, averaging across observations for each participant.

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<sup>1</sup> In an alternative model, we also included perceived meaning at  $t + 1$ . This modification significantly complicated the model but yielded a nearly identical pattern of results. For details, see Figure S2 in the Supplemental Materials.

**Table 2. Ranges, Means, Standard Deviations, and Correlations of Person Means from Nightly and Quarterly Reports – Study 1**

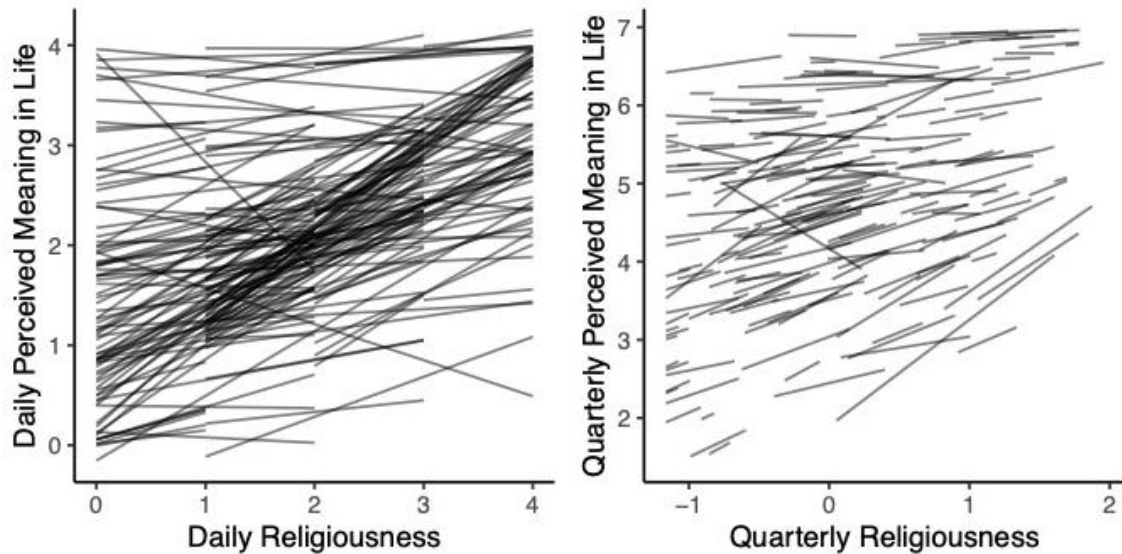
Variable	Nightly			Quarterly					
	Range	M	SD	1	2	3	Range	M	SD
1. Religion	0-4	1.64	1.41	–	.34 [.21, .45]	.22 [.09, .34]	-1.16- 1.96	-0.02	0.81
2. Perceived Meaning	0-4	2.15	1.05	.53 [.43, .62]	–	.55 [.45, .64]	1-7	4.75	1.33
3. Social Integration	1-7	4.44	1.23	.30 [.18, .42]	.60 [.51, .68]	–	1-4	3.33	0.53

*Note.* Person means were computed for each participant by averaging responses from the nightly and quarterly reports. Statistics for the nightly and quarterly reports are, respectively, on the left and right sides of the table. Range indicates observed range. All  $ps < .001$ .

**Nightly Reports.** Daily religiousness was positively associated with perceived meaning, both between-persons,  $b = .41$ , 95% CI: [.33, .50],  $\beta = .49$ ,  $p < .001$ , and within-persons,  $b = .35$ , 95% CI: [.29, .41],  $\beta = .14$ ,  $p < .001$ . (See Figure 1.) Religiousness was also positively associated with social integration, both between-persons,  $b = .33$ , 95% CI: [.17, .48],  $\beta = .25$ ,  $p < .001$ , and within-persons,  $b = .42$ , 95% CI: [.32, .53],  $\beta = .11$ ,  $p < .001$ .<sup>2</sup> Religiousness continued to predict perceived meaning in life while controlling for perceived social integration, both between-persons,  $b = .30$ , 95% CI: [.23, .37],  $\beta = .36$ ,  $p < .001$ , and within-persons,  $b = .30$ , 95% CI: [.25, .35],  $\beta = .12$ ,  $p < .001$ . Social integration was also a significant predictor, both between-persons,  $b = .41$ , 95% CI: [.33, .49],  $\beta = .40$ ,  $p < .001$ , and within-persons,  $b = .19$ , 95% CI: [.16, .21],  $\beta = .13$ ,  $p < .001$ .

<sup>2</sup> A three-way interaction emerged between condition, person-means of religiousness, and deviations from person-means (see Table S1). Simple slopes analysis suggested that the within-person link between religiousness and social integration was not significant for participants in the Loving Kindness condition with low average religiousness.

**Figure 1. Within- and Between-Persons Associations between Religiosity and Perceived Meaning in Life at the Daily and Quarterly Levels**

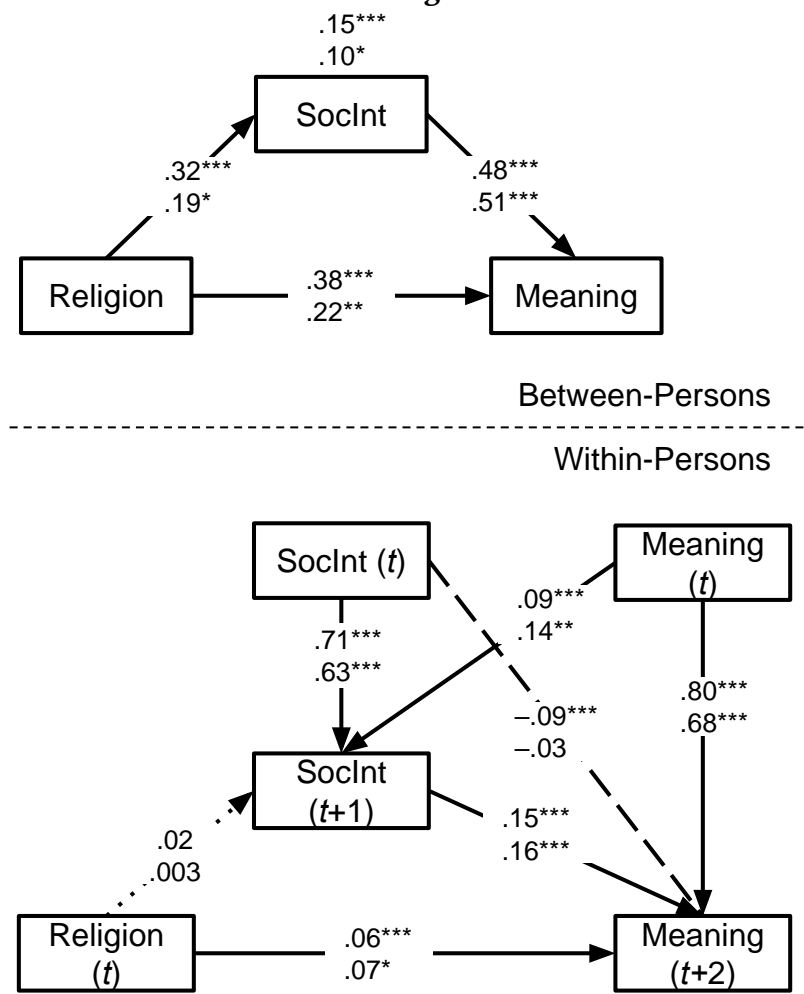


*Note.* Each plotted line indicates, for a particular participant, the association between religiousness and perceived meaning in life.

A multilevel mediation model (Figure 2) revealed that, at the between-persons level, religiousness predicted perceived meaning directly,  $b = .29$ , 95% CI: [.20, .38],  $\beta = .38$ ,  $p < .001$ , and indirectly through social integration,  $b = .12$ , 95% CI: [.06, .17],  $\beta = .15$ ,  $p < .001$ . This indirect path accounted for 28.6% of the total association (Shrout & Bolger, 2002). At the within-persons level, religiousness directly predicted changes in perceived meaning over the subsequent two days,  $b = .05$ , 95% CI: [.03, .07],  $\beta = .06$ ,  $p < .001$ . However, the indirect path through social integration on the intervening day was not significant,  $b = .002$ , 95% CI: [-.002, .006],  $\beta = .003$ ,  $p = .265$ . Whereas changes in social integration predicted changes in perceived meaning over the subsequent two days,  $b = .12$ , 95% CI: [.10, .14],  $\beta = .15$ ,  $p < .001$ , religiousness did not predict those changes in social integration,  $b = .02$ , 95% CI: [-.01, .05],  $\beta = .02$ ,  $p = .263$ . Perceived meaning, however, did predict subsequent changes in social integration,  $b = .10$ , 95% CI: [.06, .15],  $\beta = .09$ ,  $p < .001$ . Corroborating past research (Stavrova & Luhmann, 2016), these results are consistent with an “upward spiral” dynamic

between these variables. Curiously, after accounting for the indirect effect through social integration on an intervening day, social integration on the first day negatively predicted changes in perceived meaning over the subsequent two days,  $b = -.08$ , 95% CI:  $[-.01, -.06]$ ,  $\beta = -.09$ ,  $p < .001$ . Hence, if today's sense of social integration doesn't carry over into tomorrow, perceived meaning is likely to decline over the next two days. Overall, the results of this model indicate that although social integration mediates the between-persons link between daily religiousness and perceived meaning in life, it does not mediate the within-persons link.

**Figure 2. Social Integration Mediates Between-Person but not Within-Person Links between Religiousness and Perceived Meaning in Life**



*Note.* Coefficients are fully standardized, with nightly results stacked on quarterly ones. Significant indirect paths are indicated above the mediator. The dashed line indicates a path that was significant in the nightly model, but not in the quarterly model. The dotted line indicates a path that was not significant in either model.

**Quarterly Reports.** Quarterly religiousness was positively associated with quarterly perceived meaning in life, both between-persons,  $b = .55$ , 95% CI: [.35, .75],  $\beta = .31$ ,  $p < .001$ , and within-persons,  $b = .41$ , 95% CI: [.16, .65],  $\beta = .05$ ,  $p = .001$ . Religiousness was also positively associated with perceived social integration between-persons,  $b = .14$ , 95% CI: [.05, .22],  $\beta = .19$ ,  $p = .001$ , but not within-persons,  $b = .001$ , 95% CI: [-.12, .12],  $\beta = .0002$ ,  $p = .991$ . While controlling for social integration, religiousness significantly predicted perceived meaning both between-persons,  $b = .38$ , 95% CI: [.20, .55],  $\beta = .21$ ,  $p < .001$ , and within-persons,  $b = .41$ , 95% CI: [.18, .64],  $\beta = .05$ ,  $p < .001$ . Social integration was also a significant predictor, both between-persons,  $b = 1.24$ , 95% CI: [.96, 1.51],  $\beta = .44$ ,  $p < .001$ , and within-persons,  $b = .43$ , 95% CI: [.28, .59],  $\beta = .09$ ,  $p < .001$ .

A multilevel mediation model revealed that, at the between-persons level, religiousness predicted perceived meaning directly,  $b = .34$ , 95% CI: [.14, .55],  $\beta = .22$ ,  $p = .001$ , and indirectly through social integration,  $b = .15$ , 95% CI: [.02, .28],  $\beta = .10$ ,  $p = .027$ . This indirect path accounted for 30.5% of the total association. At the within-persons level, religiousness predicted changes in perceived meaning directly,  $b = .12$ , 95% CI: [.02, .22],  $\beta = .07$ ,  $p = .022$ , but *not* indirectly through changes in social integration,  $b = .001$ , 95% CI: [-.01, .02],  $\beta = .000$ ,  $p = .911$ . Whereas changes in social integration predicted changes in perceived meaning,  $b = .39$ , 95% CI: [.22, .55],  $\beta = .16$ ,  $p < .001$ , religiousness did not predict changes in social integration,  $b = .002$ , 95% CI: [-.04, .04],  $\beta = .003$ ,  $p = .911$ . Overall, the results of this model indicate that, at the quarter-to-quarter level, social integration mediates



the between-persons link between religiousness and perceived meaning in life, but not the within-persons link.<sup>3</sup>

### **Discussion**

Using over 13,000 daily observations, and over 1,600 quarterly observations, we found that people who are more religious tend to find their lives more meaningful than people who are less religious, and the times when a person is more religious tend to also be times when they feel a greater sense of meaning in their life. These results corroborate previous findings (Kucinkas et al., 2018; Steger & Frazier, 2005), and go beyond them, showing that these links hold both at micro (day-to-day) and macro (quarter-to-quarter) levels, and that these links are independent of social integration.

We also found that, at the micro and macro levels, the between-persons association between religiousness and perceived meaning was partially explained by social integration. However, this mechanism accounted for less than a third of the overall between-persons association. Moreover, within individuals over time, religiousness predicted changes in perceived meaning in life, but did not predict changes in social integration. Hence, we found no evidence that the link between religiousness and changes in perceived meaning is explained by changes in social integration. While social *integration* is not identical with social *mattering*, these results offer preliminary evidence that the Social Mattering Hypothesis is only part of

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<sup>3</sup> The religiousness measure used in these quarterly reports (and in Studies 2-4) assessed three facets of the construct: “intrinsic” religiousness (self-rated importance of religion), public religious activities (e.g., attending services), and solitary religious activities (e.g., praying alone). Some researchers argue for delineating these (Idler et al., 2003). To ensure that our measures did not overemphasize non-social aspects of religiousness, thereby disadvantaging the Social Mattering Hypothesis, in this study and in Studies 2-4, we reran our analyses, recomputing religiousness as follows: (1) excluding solitary activities items; (2) including intrinsic religiousness items only; (3) including public activities items only, and (4) including solitary activities items only. In every case, the pattern of results was either identical to, or only modestly different from, the results reported in the main text. The overall pattern of results maintains our confidence in the reported findings. See the Supplemental Materials for details and discussion.

the story behind the link between religiousness and perceived meaning in life. Other mechanisms need to be considered as well.

### Studies 2 and 3

In the next two studies, we tested the Social Mattering Hypothesis directly, examining whether perceived social mattering mediates the between-persons link between religiousness and perceived meaning in life. To give the Social Mattering Hypothesis the best chance of success, we also tested whether a broader “social well-being” latent variable (indicated by perceived social mattering as well as social integration and contribution) mediated this link. If religiousness is still significantly associated with perceived meaning even after accounting for the indirect path through social well-being, this would be strong evidence for the insufficiency of the Social Mattering Hypothesis.

The data for Study 2 come from Wave V of The Baylor Religion Survey (Froese, 2017), a multi-year study on religion in the United States. Wave V was the first in the series to include a measure of social mattering. Although the survey covered a range of topics, we only report on the measures relevant for present purposes. Some of the measures used in that study were either not standard, validated measures or were abbreviated versions of such measures.<sup>4</sup> In Study 3, we assessed the same constructs, but used complete measures with verified psychometric properties.

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<sup>4</sup> Wave V of The Baylor Religion Survey included a standard measure of perceived social mattering, an abbreviated version of a standard measure of perceived meaning in life, and nonstandard measures of religiousness, social integration, and social contribution. We selected all variables prior to conducting any analyses.

## **Study 2 Method**

**Participants.** The survey was administered in early 2017 by Gallup, on behalf of researchers at Baylor University. They mailed 11,000 pen and paper surveys along with an invitation letter, return envelope, and a \$1 USD cash incentive. Approximately two weeks later, Gallup mailed reminders and a second copy of the survey to addresses that had not responded. The final sample included  $N = 1,501$  responses, a 13.6% response rate ( $M_{age} = 54.95$ ,  $SD_{age} = 17.08$ ; 56.9% female, 40.8% male, 2.3% other or declined to answer; 2.6% Asian, 10.9% Black, 77.9% White, 2.8% mixed race, < 1% other race, 5.0% declined to answer; 25.0% Catholic Christian, 48.6% Protestant Christian, 1.9% Jewish, < 1% Muslim, < 1% Hindu, < 1% Orthodox Christian, < 1% Sikh, < 1% Buddhist, < 1% Unitarian Universalist, 2.7% other religion, and 14.7% “None”).

**Procedure and Measures.** Participants used Likert scales to respond to: “How religious do you consider yourself to be?” (1 = “Not religious, 4 = “Very religious”); “How often do you attend religious services at a place of worship?” (0 = “Never”, 7 = “Several time a week”); “About how often do you spend time alone praying outside of religious services?” (0 = “Never”, 5 = “Several time a day”); and “Outside of attending religious services, about how often do you spend time alone reading the Bible, Koran, Torah, or other sacred book?” (0 = “Never”, 7 = “Several times a week”). These items displayed good internal reliability (standardized coefficient  $\alpha = .89$ ). Given the different response scales, religiousness was computed as the standardized average.

Participants completed a 3-item version of the Meaning in Life Questionnaire – Presence subscale (Steger et al., 2006): “I have a good sense of what makes my life meaningful”; “I have discovered a satisfying life purpose”; and “My life has no clear purpose”

(reverse-coded). Participants responded using a Likert scale (1 = “Strongly disagree”, 5 = “Strongly Agree”). This measure displayed adequate internal reliability (coefficient  $\alpha = .77$ ).

Participants completed the General Mattering Scale (Marcus, 1991), a 5-item measure of perceived mattering to others (sample item: “How important do you feel you are to other people?”). They responded using Likert scales (1 = “Not at all”, 4 = “A lot”). This measure displayed good internal reliability (coefficient  $\alpha = .81$ ).

Participants completed 3-item measures of social integration and contribution. The social integration measure asked participants to indicate how close they felt to their family, friends, and neighbors (1 = “Not at all close”, 4 = “Very close”). The social contribution scale asked participants whether they had engaged in several community service activities in the past year (sample item: “Worked with neighbors to make a positive change in the local community”). Participants could respond “Yes” or “No.” These measures of social integration and contribution displayed modest but acceptable internal reliability (standardized coefficient  $\alpha$ s = .60 and .62 respectively).

### **Study 3 Method**

**Participants.** In December 2019, we recruited 489 adults from across the United States using Amazon’s Mechanical Turk, inviting only workers with > 95% approval ratings. Participants were paid \$0.50. Median completion time was 5.42 minutes (range: 1.4–876.4). We embedded two attention checks in this survey, which read: “This is an attention check. Please leave this question blank.” Participants who responded to both ( $n = 10$ ) were excluded from analysis, leaving  $N = 479$  participants ( $M_{Age} = 37.82$ ,  $SD_{Age} = 12.27$ ; 53.7% women, 44.9% men, 1.3% other gender or decline to answer; 6.1% Asian or Asian American, 8.4% Black or African American, 4.0% Hispanic or Latinx, 72.9% White or European American, 6.7%

mixed race, 2.1% other or declined to answer). We did not assess religious affiliation. Based on recent large-scale national surveys (Pew, 2018), we assume that the majority was likely Christian—as was the case in Studies 1 and 2.

**Measures.** We assessed religiousness using the Duke University Religion Index (Koenig & Büssing, 2010). This questionnaire asks one question each about public and solitary religious activities: “How often do you attend religious meetings (e.g., church, mosque, synagogue)?” (1 = “Never”, 6 = “More than once a week”); “How often do you spend time in private religious activities, such as prayer, meditation, or studying religious texts?” (1 = “Rarely or never”, 6 = “More than once a day”). Participants then used a Likert scale (1 = “Definitely not true of me”, 5 = “Definitely true of me”) to indicate how true three statements were of them (sample item: “My religious beliefs are what really lie behind my whole approach to life”). Religiousness scores were the standardized average of these items (standardized coefficient  $\alpha = .92$ ).

We assessed perceived meaning in life using the full version of the Meaning in Life Questionnaire – Presence subscale (Steger et al., 2006). This measure displayed excellent internal reliability (coefficient  $\alpha = .93$ ). We assessed social mattering using the General Mattering Scale, which displayed excellent internal reliability (coefficient  $\alpha = .90$ ).

We also assessed social integration and contribution, using the corresponding subscales from the Social Well-Being Scales (Keyes, 1998). Participants used Likert scales (1 = “Strongly disagree”, 7 = “Strongly agree”) to respond to 6 items about their sense of social integration (sample item: “I feel close to other people in my community”) and social contribution (sample item: “I have something valuable to contribute to the world”). Both measures displayed good internal reliability (coefficient  $\alpha$ s = .86, .83 respectively).

## **Results**

In Studies 2–3, all variables were significantly correlated with each other. Descriptive statistics and correlations for both studies are available in the Supplemental Materials (Table S2). We used the *lavaan* package in R (Rosseel, 2012) to run mediation models in which perceived meaning was predicted by religiousness both directly and indirectly through social mattering (Figure 3). We estimated standard errors using the bootstrap technique, with 5,000 resamples. In Study 2, we used Full Information Maximum Likelihood, since 37 participants had missing data.<sup>5</sup> Because these models were saturated, fit indices were not available.

In Study 2, social mattering significantly mediated the association between religiousness and perceived meaning,  $b = .06$ , 95% CI: [.04, .08],  $\beta = .07$ ,  $p < .001$ . However, this indirect path only accounted for 25.3% of the total association. The direct path remained significant,  $b = .17$ , 95% CI: [.13, .21],  $\beta = .19$ ,  $p < .001$ . In Study 3, we observed the same pattern of results. Social mattering mediated the link between religiousness and perceived meaning in life,  $b = .16$ , 95% CI: [.08, .26],  $\beta = .09$ ,  $p < .001$ . Yet the indirect path only accounted for 25.9% of the total association. The direct path remained significant,  $b = .47$ , 95% CI: [.33, .60],  $\beta = .26$ ,  $p < .001$ .

We then tested conceptually similar models, using social integration and contribution as additional indicators of a latent “social well-being” variable (see Figure S3). In Study 2, the model showed good fit:  $\chi^2(4) = 31.83$ ,  $p < .001$ ; CFI = .968; TLI = .919; RMSEA = .068; SRMR = .023. The latent factor mediated the association between religiousness and perceived meaning,  $b = .17$ , 95% CI: [.13, .21],  $\beta = .19$ ,  $p < .001$ . This indirect path accounted for 74.4% of the total association. Nevertheless, the direct path remained significant,  $b = .06$ , 95% CI:

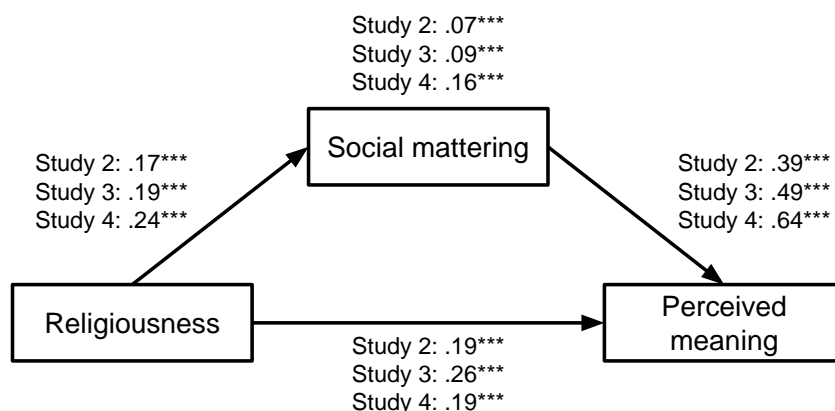
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<sup>5</sup> Listwise deletion produced an identical pattern of results.

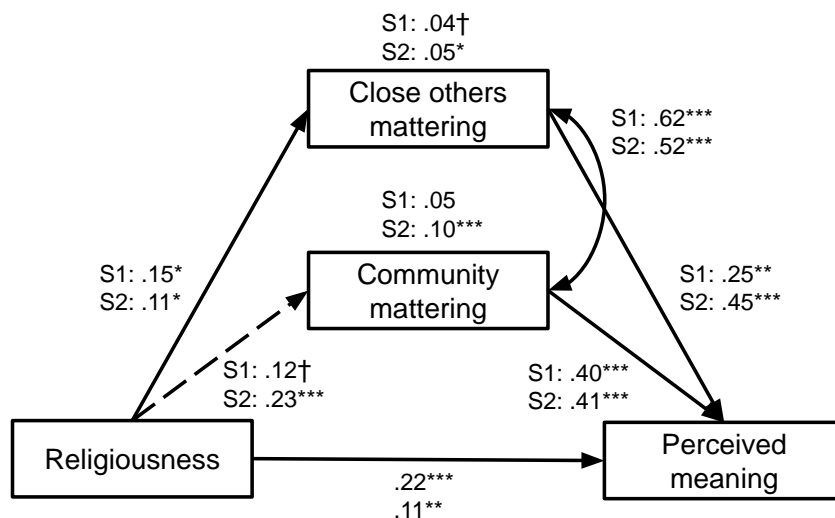
[.01, .11],  $\beta = .07$ ,  $p = .022$ . The same pattern of results emerged in Study 3. The model showed acceptable fit:  $\chi^2(4) = 16.57$ ,  $p < .001$ ; CFI = .983; TLI = .958; RMSEA = .081; SRMR = .025. The latent factor significantly mediated the link between religiousness and perceived meaning,  $b = .41$ , 95% CI: [.27, .55],  $\beta = .23$ ,  $p < .001$ . The indirect path accounted for 63.9% of the total association. Yet the direct path remained significant,  $b = .23$ , 95% CI: [.09, .36],  $\beta = .13$ ,  $p = .001$ .

**Figure 3. Perceived Social Mattering Mediates the Link Between Religiousness and Perceived Meaning in Life – Studies 2-5**

#### Studies 2-4



#### Study 5



*Note.* † indicates  $p < .1$ ; \* indicates  $p < .05$ ; \*\* indicates  $p < .005$ ; \*\*\* indicates  $p < .001$ . All coefficients are fully standardized. Indirect paths are indicated above the mediator. In Studies 2-3, we assessed perceived social mattering using the General Mattering Scale. In Study 4, we used the

Perceived Interpersonal Mattering Questionnaire. In Study 5, we separately assessed perceived mattering to close others and to one's community. S1 and S2 indicate Samples 1 and 2 respectively.

## Discussion

In Studies 2-3, we tested the Social Mattering Hypothesis in two samples of American adults (combined  $N = 1,980$ ). The pattern of results was identical across studies and consistent with the findings from Study 1. Perceived social mattering partially explained the between-persons link between religiousness and perceived meaning in life, but only accounted for about a quarter of the overall association. We also tested whether social well-being, a broader construct composed of perceived social mattering as well as social integration and contribution, could explain this association. Although it accounted for a substantially larger proportion of the association, the direct link between religiousness and perceived meaning remained significant. This suggests that social variables may not fully explain why religiousness is associated with perceived meaning in life.

## Study 4

In this study we aimed to replicate the previous findings and also to test the Cosmic Mattering Hypothesis by examining whether perceived cosmic mattering mediates the association between religiousness and perceived meaning. We also aimed to compare this mediating path with that of social mattering. **The** data were collected as a part of a study investigating individuals' perceptions of their own significance. The study included several measures beyond the scope of the present paper. We plan to report additional analyses in other publications.



## **Method**

**Participants.** Using the same procedure and payment as in Study 3, in March 2019 we recruited 301 adults from around the United States using Amazon’s Mechanical Turk. Median completion time was 7.28 minutes (range: 2.93–25.28). We used the same attention checks as in Study 3. Participants who failed both ( $n = 6$ ) were excluded from analysis, leaving  $N = 295$  participants ( $M_{\text{age}} = 39.28$ ,  $SD_{\text{age}} = 13.54$ ; 59.7% women, 40.3% men; 6.1% Asian, 7.5% Black or African American, 4.4% Hispanic or Latinx, 77.6% White or European American, 3.4% mixed race, 1.0% other). We did not assess religious affiliation. Based on recent large-scale national surveys (Pew, 2018), we assume that the majority was likely Christian—as was the case in Studies 1 and 2.

**Measures.** We assessed religiousness using the Duke Religion Index, which again displayed excellent internal reliability (coefficient  $\alpha = .93$ ). We assessed perceived meaning in life using a 5-item version of the Perceived Personal Meaning Scale (Wong, 1998). Participants used Likert scales (1 = “Strongly disagree”, 7 = “Strongly agree”) to indicate their agreement with a series of statements about their lives (sample item: “My life as a whole has meaning”). This measure showed good internal reliability (coefficient  $\alpha = .89$ ).

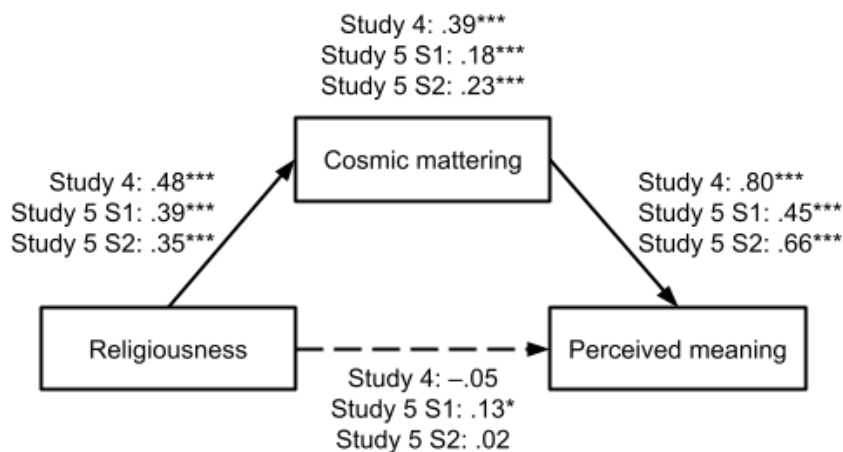
We aimed to assess perceived social and cosmic mattering using separate but parallel scales. Since no such measures existed, we created two 8-item questionnaires, the Perceived Interpersonal Mattering Questionnaire (PIMQ) and the Perceived Cosmic Mattering Questionnaire (PCMQ). Participants used Likert scales (1 = “Strongly disagree”, 7 = “Strongly agree”) to indicate their agreement with statements about their lives. These statements were based on items from existing measures (L. S. George & Park, 2017; Marcus, 1991), and were phrased in a directly parallel manner, differing only in how they were contextualized. For example, the PIMQ included: “My life matters to other people” and

“Others consider my life to have value and significance.” The corresponding items from the PCMQ were: “My life matters in the grand scheme of the universe” and “My life has value and significance, in a cosmic context.” The PIMQ and PCMQ each demonstrated excellent internal reliability (coefficient  $\alpha$ s = .96, .98 respectively). The Supplemental Materials contain the full text of these scales and results of an exploratory and confirmatory factor analyses (Table S3 and Figure S4).

### **Results**

All study variables were significantly correlated with each other. Descriptive statistics and correlations are available in the Supplemental Materials (Table S4). To replicate our previous findings, we constructed a mediation model in which religiousness predicted perceived meaning both directly and indirectly via social mattering (Figure 3). The model indicated a significant indirect path,  $b = .23$ , 95% CI: [.13, .33],  $\beta = .16$ ,  $p < .001$ , which accounted for 45.6% of the total association between religiousness and perceived meaning. The direct path remained significant,  $b = .28$ , 95% CI: [.16, .40],  $\beta = .19$ ,  $p < .001$ . We also constructed a parallel model in which cosmic mattering was the mediator (Figure 4). The indirect path was significant,  $b = .57$ , 95% CI: [.44, .72],  $\beta = .39$ ,  $p < .001$ , but the direct path was not,  $b = -.07$ , 95% CI: [-.19, .05],  $\beta = -.05$ ,  $p = .268$ . This indicates that perceived cosmic mattering accounted for the entirety of the association between religiousness and perceived meaning in life.

**Figure 4. Cosmic Mattering Mediates the Link Between Religiousness and Perceived Meaning in Life – Studies 4-5**



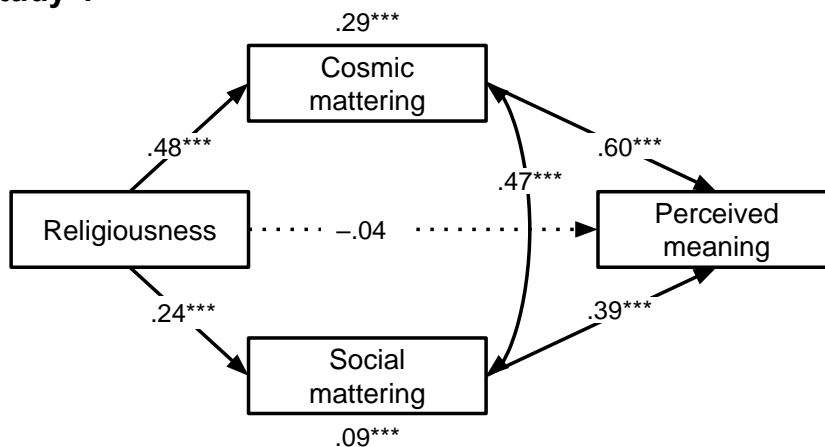
*Note.* \* indicates  $p < .05$ ; \*\* indicates  $p < .005$ ; \*\*\* indicates  $p < .001$ . Coefficients are fully standardized. Indirect paths are indicated above the mediator.

Finally, we ran a parallel mediation model in which social and cosmic mattering each mediated the link between religiousness and perceived meaning in life (Figure 5). The model revealed significant indirect paths through social mattering,  $b = .14$ , 95% CI: [.08, .21],  $\beta = .09$ ,  $p < .001$ , and cosmic mattering,  $b = .43$ , 95% CI: [.32, .55],  $\beta = .29$ ,  $p < .001$ . The direct path was not significant,  $b = -.06$ , 95% CI: [-.16, .04],  $\beta = -.04$ ,  $p = .254$ . Hence, the two mediators accounted for the entirety of the total association. A pairwise comparison between the two indirect paths (Hayes, 2017) revealed that cosmic mattering accounted for significantly more of the overall association than did social mattering,  $\Delta b = .29$ , 95% CI: [.17, .41],  $\Delta\beta = .19$ ,  $p < .001$ . The indirect path through perceived social mattering accounted for 24.4% of the total association, whereas the path through perceived cosmic mattering accounted for 75.6%. Additional pairwise comparisons indicated that religiousness was more strongly associated with perceived cosmic mattering than with perceived social mattering,  $\Delta b = .67$ , 95% CI: [.49, .84],  $\Delta\beta = .24$ ,  $p < .001$ . However, the links between the two forms of

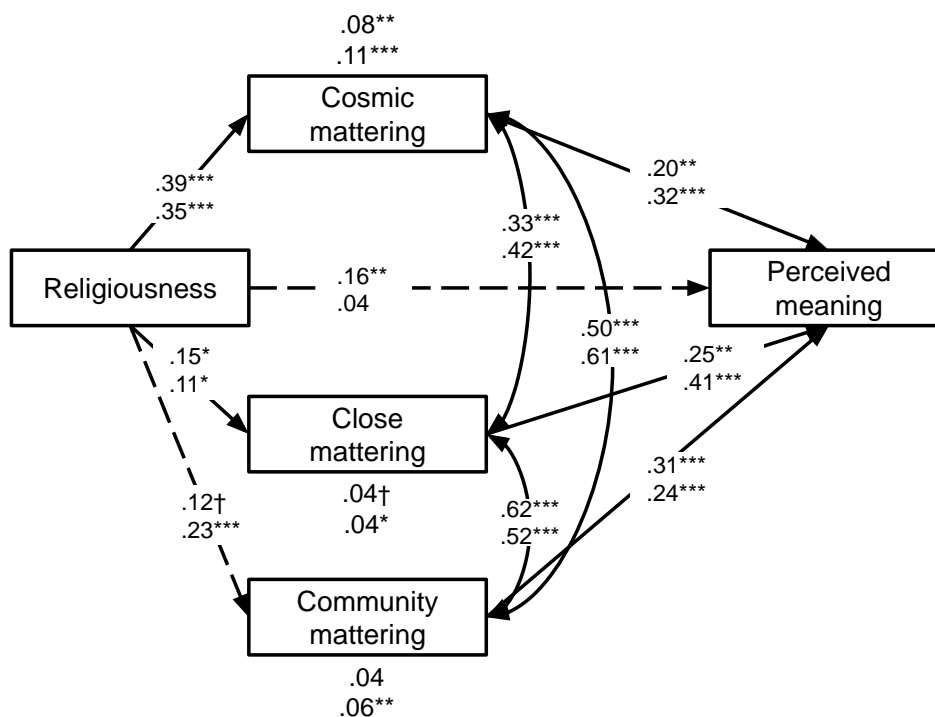
perceived mattering and perceived meaning in life did not differ in magnitude,  $\Delta b = -.01$ , 95% CI:  $[-.17, .15]$ ,  $\Delta\beta = .21$ ,  $p < .001$ .

**Figure 5. Perceived Social and Cosmic Mattering Each Mediate the Link Between Religiousness and Perceived Meaning in Life – Studies 4-5**

#### Study 4



#### Study 5



Note. † indicates  $p < .1$ ; \* indicates  $p < .05$ ; \*\* indicates  $p < .01$ ; \*\*\* indicates  $p < .001$ . Coefficients are fully standardized. Indirect paths are indicated next to the mediator. In Study 5, coefficients for each sample are presented, with Sample 1 on top. Dashed lines indicate paths that were significant in one but not both samples.

## Discussion

In this study, we again found that perceived social mattering only partly explained the link between religiousness and perceived meaning in life. Perceived cosmic mattering also explained this link. Indeed, after accounting for this mechanism, religiousness and perceived meaning were no longer significantly associated. Comparing these mechanisms side-by-side, each partly explained the association, but perceived cosmic mattering accounted for a much larger proportion. Thus, while both the Social Mattering Hypothesis and the Cosmic Mattering Hypothesis were supported, the latter seems to identify a stronger mechanism. As we speculated in the introduction, religion may be an unique source of perceived cosmic significance. Hence, this may be the primary means by which religion makes life feel more meaningful.

## Study 5

In this study, we aimed to use more nuanced measures of perceived social mattering. After all, a person might feel that they matter to friends and family, but not to their community or society. Moreover, some forms of perceived social mattering may play a larger role than others in explaining the association between religiousness and perceived meaning in life. Hence, we tested whether perceived mattering to close others, to one's community, and in the cosmos each mediate the link between religiousness and perceived meaning. **These** data were collected as a part of a study on different forms of perceived mattering and include other measures beyond the scope of the present paper. We plan to report additional analyses in another publication.

## **Method**

**Participants.** We recruited two samples. The first was composed of undergraduates attending a university in North Carolina. The second was composed of adults from around the United States.

*Sample 1.* In October 2020, we recruited 253 participants using a departmental participant pool. These participants completed the study in exchange for course credit. To screen for low-quality responses, a research assistant read the answers to an open-ended question, flagging any with nonsensical or clearly irrelevant text.<sup>6</sup> One response was flagged and excluded from analysis, leaving  $N = 252$  participants in this sample ( $M_{\text{age}} = 19.08$ ,  $SD_{\text{age}} = 1.76$ ; 66.6% women, 32.5% men, < 1% another gender; 12.7% Asian or Asian American, 9.5% Black or African American, 5.2% Hispanic or Latinx, 61.5% White or European American, 9.1% mixed race, 2.0% another race or declined to answer). We did not assess religious affiliation. Based on recent large-scale national surveys (Pew, 2018), we assume that the majority was likely Christian—as was the case in Studies 1 and 2.

*Sample 2.* Using the same procedure and payment as in Studies 3-4, in November 2020, we recruited 401 adults from around the United States using Amazon’s Mechanical Turk. We screened for low-quality responses using the same procedure as in Sample 1. In this sample, 14 responses were flagged, leaving  $N = 387$  participants ( $M_{\text{age}} = 39.44$ ,  $SD_{\text{age}} = 12.10$ ; 51.2% women, 47.8% men, 1.0% other or prefer not to say; 3.6% Asian, 29.2% Black or African American, 3.4% Hispanic or Latinx, 57.1% White or European American, 5.7% mixed race, 1.0% another race or declined to answer).

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<sup>6</sup> The open-ended question read: “On the previous page you responded to some questions about the degree to which you feel that your life matters. Would you please explain why you responded in the way that you did?” We included question to test an independent hypothesis and plan to report results in another publication.

**Measures.** We assessed religiousness with the single-item measure used in the General Social Survey: “To what extent do you consider yourself a religious person?” Participants responded with a Likert scale (1 = “Not at all religious”, 5 = “Extremely religious”). In Study 2, responses to a similar item (“How religious do you consider yourself to be?”) were highly correlated ( $r = .86$ ) with the total religiousness scores.

We assessed perceived meaning in life using the same 5-item version of the Perceived Personal Meaning Scale from Study 4, along with two negatively worded items (“My life is meaningless”, “My existence is empty of meaning”). We included these to help compensate for acquiescent response styles (Winkler et al., 1982). The measure displayed good internal reliability (coefficient  $\alpha$ s = .85 in Sample 1, .93 in Sample 2).

We used three measures of perceived mattering. To assess perceived cosmic mattering, we used the Perceived Cosmic Mattering Questionnaire – Short Form (PCMQ–SF), a 4-item version of the previous measure. In Study 4, the average of these 4 items was very highly correlated with the 8-item total ( $r = .99$ ). In this study, the PCMQ–SF displayed excellent internal reliability (coefficient  $\alpha$ s = .92 in Sample 1, .97 in Sample 2). To assess perceived mattering to close others and mattering to one’s community, we used similar 4-item scales, based on the Perceived Interpersonal Mattering Questionnaire. The Perceived Close Others Mattering Questionnaire (PCOMQ) asked participants about their sense of mattering to people they know personally (sample items: “My life matters to the people I’m close with”; “My life is important to those who know me”). This measure displayed excellent internal reliability (coefficient  $\alpha$ s = .95 in Sample 1, .96 in Sample 2). The Perceived Societal Mattering Questionnaire (PSMQ) used parallel items to ask about participants’ perceived mattering to their communities (sample items: “My life matters to my society”; “My life is

important in my community”). This measure too displayed excellent internal reliability (coefficient  $\alpha$ s = .94 in Sample 1, .97 in Sample 2). The full text of these scales and results of factor analyses are included in the Supplemental Materials (Table S5).

## **Results**

All study variables were positively correlated with each other in both samples (Table S6), with one exception: religiousness and community mattering were only marginally correlated in Sample 1 ( $r = .12, p = .052$ ). Comparing the samples (see Table 3), we found that the undergraduates (Sample 1) reported significantly greater religiousness and community mattering, and significantly less cosmic mattering, than the nationwide adults (Sample 2). These differences were relatively small, however. Our dependent variable, perceived meaning in life, did not differ between samples.

**Table 3. Cross-Sample Comparisons of Study Variables – Study 5**

Variable	<i>M</i> ( <i>SD</i> ) Sample 1	<i>M</i> ( <i>SD</i> ) Sample 2	<i>t</i>	<i>p</i>	<i>d</i>
<b>Religiousness</b>	<b>2.69 (1.27)</b>	<b>2.27 (1.40)</b>	<b>3.87</b>	<b>&lt; .001</b>	<b>.31</b>
Perceived Meaning	5.67 (0.98)	5.56 (1.32)	1.07	.287	.09
Close Mattering	6.32 (0.86)	6.22 (0.96)	1.31	.192	.11
<b>Community Mattering</b>	<b>5.33 (1.18)</b>	<b>4.94 (1.55)</b>	<b>3.39</b>	<b>&lt; .001</b>	<b>.27</b>
<b>Cosmic Mattering</b>	<b>4.43 (1.70)</b>	<b>4.74 (1.93)</b>	<b>-2.08</b>	<b>.038</b>	<b>-.17</b>

*Note.* *M* and *SD* indicate sample mean and standard deviation. *t* and *p* indicate the test statistic and *p*-value from a two sample t-test. *d* indicates a Cohen’s *d* effect size. In these comparisons, we had 80% power to detect differences as small as  $d = .14$ .

We first constructed a multigroup path model in which religiousness predicted perceived meaning both directly and indirectly via close and community mattering (Figure 3). We allowed path coefficients to be freely estimated across samples, as a likelihood ratio test indicated that this significantly improved model fit,  $\Delta\chi^2(3) = 29.99, p < .001$ . This reduced the number of degrees of freedom to zero, making fit indices unavailable. This model



indicated that, in Sample 1, the indirect path through close mattering was marginally significant,  $b = .03$ , 95% CI: [.005, .067],  $\beta = .04$ ,  $p = .070$ , and the path through community mattering was also not significant,  $b = .04$ , 95% CI: [-.002, .091],  $\beta = .05$ ,  $p = .108$ . The direct path from religiousness to perceived meaning remained significant,  $b = .17$ , 95% CI: [.09, .25],  $\beta = .22$ ,  $p < .001$ . In Sample 2, the model indicated significant indirect paths through close mattering,  $b = .05$ , 95% CI: [.01, .09],  $\beta = .05$ ,  $p = .028$ , and community mattering,  $b = .09$ , 95% CI: [.05, .15],  $\beta = .10$ ,  $p < .001$ , as well as a significant direct path,  $b = .10$ , 95% CI: [.04, .16],  $\beta = .11$ ,  $p = .001$ . A pairwise comparison between the two indirect paths revealed that they did not differ significantly in magnitude,  $\Delta b = -.04$ , 95% CI: [-.10, .01],  $\beta = -.05$ ,  $p = .135$ . Together, these two indirect paths accounted for 57.1% of the total association,  $b = .24$ , 95% CI: [.15, .32],  $\beta = .25$ ,  $p < .001$ . In sum, we found that perceived close and community mattering each mediated the association between religiousness and perceived meaning in life amongst nationwide adults but not amongst undergraduates.

We then constructed a similar model in which cosmic mattering was the mediator (Figure 4). Again, we allowed path coefficients to be freely estimated across samples, as a likelihood ratio test indicated that this improved model fit,  $\Delta\chi^2(2) = 20.44$ ,  $p < .001$ . In Sample 1, we found that cosmic mattering significantly mediated the link between religiousness and perceived meaning,  $b = .14$ , 95% CI: [.08, .20],  $\beta = .18$ ,  $p < .001$ , though the direct path also remained significant,  $b = .10$ , 95% CI: [.01, .19],  $\beta = .13$ ,  $p = .025$ . Cosmic mattering was a significant mediator in Sample 2 also,  $b = .22$ , 95% CI: [.16, .29],  $\beta = .23$ ,  $p < .001$ . However, in Sample 2, we observed no significant direct path,  $b = .02$ , 95% CI: [-.06, .09],  $\beta = .02$ ,  $p = .625$ . Hence, in both samples, cosmic mattering mediated the link between religiousness

and perceived meaning. In our sample of nationwide adults, it accounted for the entirety of the total association. In our sample of undergraduates, it accounted for 60.8%.

Finally, we constructed a third model in which all three forms of mattering mediated the link between religiousness and perceived meaning in life (Figure 5). Again, we allowed path coefficients to be freely estimated across samples, as a likelihood ratio test indicated that this improved model fit,  $\Delta\chi^2(4) = 47.75, p < .001$ . In Sample 1, cosmic mattering was a significant mediator,  $b = .06, 95\% \text{ CI: } [.02, .10], \beta = .08, p = .005$ , close mattering was marginally significant,  $b = .03, 95\% \text{ CI: } [.004, .066], \beta = .04, p = .077$ , and community mattering was not significant,  $b = .03, 95\% \text{ CI: } [-.001, .071], \beta = .04, p = .118$ . The direct path from religiousness to perceived meaning was also significant,  $b = .12, 95\% \text{ CI: } [.04, .21], \beta = .16, p = .005$ . In Sample 2, we observed significant indirect paths through cosmic mattering,  $b = .11, 95\% \text{ CI: } [.07, .15], \beta = .11, p < .001$ , close mattering,  $b = .04, 95\% \text{ CI: } [.01, .08], \beta = .04, p = .026$ , and community mattering,  $b = .05, 95\% \text{ CI: } [.02, .09], \beta = .06, p = .003$ . The direct path from religiousness to perceived meaning was not significant,  $b = .04, 95\% \text{ CI: } [-.02, .09], \beta = .04, p = .232$ . Pairwise comparisons between these three indirect paths revealed that close and community mattering did not differ significantly in magnitude,  $\Delta b = .01, 95\% \text{ CI: } [-.04, .06], \beta = .01, p = .643$ . However, the indirect path through cosmic mattering was significantly larger than that of close mattering,  $\Delta b = .07, 95\% \text{ CI: } [.01, .12], \beta = .07, p = .012$ , and community mattering,  $\Delta b = .05, 95\% \text{ CI: } [.01, .10], \beta = .06, p = .022$ .

Pairwise comparisons also revealed that, in both samples, religiousness was more strongly associated with perceived cosmic mattering than with either perceived close or community mattering ( $\Delta b$ s between .23 and .43, all  $p$ s  $< .001$ ). Amongst undergraduates, perceived cosmic mattering was *less* strongly associated with perceived meaning in life than

was perceived community mattering ( $\Delta b = -.14, p = .040$ ), but not perceived close others mattering ( $\Delta b = -.17, p = .160$ ). Amongst nationwide adults, perceived cosmic mattering was less strongly associated with perceived meaning in life than was perceived close others mattering ( $\Delta b = -.34, p < .001$ ), but not perceived community mattering ( $\Delta b = .01, p = .841$ ).

## **Discussion**

In this study, we replicated our previous findings using measures that allowed for more fine-grained distinctions between forms of social mattering. The results from the sample of nationwide adults were fully consistent with our previous findings. Whereas perceived mattering to close others and to one's community partly explained the association between religiousness and perceived meaning, perceived cosmic mattering fully explained it. In a side-by-side comparison, perceived close, community, and cosmic mattering appeared to function as independent mechanisms, though perceived cosmic mattering was significantly stronger than the others. In our sample of undergraduates, we found a somewhat different pattern of results. Perceived cosmic mattering partially explained the link between religiousness and perceived meaning, but perceived close and community mattering did not. Perceived close and community mattering were strongly associated with perceived meaning in life. But religiousness was only weakly associated with perceived mattering to close others, and not significantly associated with perceived mattering in one's community. Even after accounting for these three mechanisms, there remained a significant association between religiousness and perceived meaning.

What could explain these differences across samples? We offer two speculative explanations. Religions typically bring people into communities (Graham & Haidt, 2010). However, this may be a less distinctive benefit in contexts, such as universities, that afford

plentiful social opportunities. Hence, religiousness may not have been associated with perceived community mattering amongst college students because they have ample alternative forms of community. But, why didn't perceived cosmic mattering fully explain the link between religiousness and perceived meaning in life amongst undergraduates (as it did amongst nationwide adults). One possibility is that perceived coherence (the sense understanding one's life and place in the world) plays an outsized role in explaining the link between religiousness and perceived meaning amongst college students. Perceived coherence supports perceptions of meaning in life (Heintzelman et al., 2013), and the college years are often marked by the questioning of one's childhood beliefs and worldview (Bryant & Astin, 2008; Lee, 2002). Hence, more religious students may see greater meaning in their lives because they have more stable belief systems.

In any case, a consistent finding across samples was that, of the variables assessed, perceived cosmic mattering was the strongest explanation for the association between religiousness and perceived meaning in life. This supports our previous conclusion that the Cosmic Mattering Hypothesis identifies a stronger mechanism than the Social Mattering Hypothesis.

### General Discussion

While past research has found religiousness and perceived meaning in life to be positively associated, relatively little attention has been paid to testing explanations for this finding. In five studies, with six independent samples (total  $N = 3,141$ ), we tested two candidate explanations. The Social Mattering Hypothesis proposed that religiousness comes with a sense of social significance, which supports perceptions of meaning in life. The Cosmic

Mattering Hypothesis proposed that religiousness comes with a sense of cosmic significance, which fosters a sense of meaning in life. Our findings support both hypotheses but suggest that perceived cosmic mattering is the stronger mechanism.

In Study 1 we found that, although social integration partially explained the between-persons association between religiousness and perceived meaning, it accounted for less than a third of this link and did not explain the within-persons association. That is, while an individual's religiousness predicted subsequent changes in their perceptions of meaning in life, we found no evidence that this process was explained by changes in social integration. In Studies 2–4 ( $N = 2,913$ ) we consistently found that perceived social mattering explained about a third of the between-persons association between religiousness and perceived meaning. These findings prompt an examination of other mechanisms.

In Studies 4-5, we found that perceived cosmic mattering also explained the between-persons association between religiousness and perceived meaning. Indeed, after accounting for this mechanism, we found no significant links between religiousness and perceived meaning in samples of nationwide adults. In side-by-side comparisons of these two mechanisms, we found that perceived social and cosmic mattering each explained the association, but perceived cosmic mattering accounted for significantly more of this association than did perceived social mattering. Hence, while both the Social and Cosmic Mattering Hypotheses were empirically supported, the Cosmic Mattering Hypothesis appears to identify the stronger mechanism.

In Studies 4-5, religiousness consistently showed stronger links with perceived cosmic mattering than with the social forms of perceived mattering. However, perceived cosmic mattering did *not* show consistently stronger links with perceived meaning in life than did the

social forms of perceived mattering. Hence, it appears that perceived cosmic mattering is not a more potent source of perceived meaning than perceived social mattering. Rather, perceived cosmic mattering appears to be what is most uniquely provided by religious faith.

### Limitations and Future Directions

Our interpretations of the results are based on the literature that suggests that religiousness promotes meaning in life and not vice versa. Yet, because these studies were observational rather than experimental, we are unable to draw causal conclusions. In Study 1, we were able to examine within-person processes, testing whether religiousness predicted changes in social integration and perceived meaning in life. However, the studies in which we examined perceived cosmic mattering (Studies 4–5) were cross-sectional. Hence, one limitation of this work is that we could not temporally separate the predictor, mediator, and outcome, and could only test for between-person associations. Hence, future studies should examine within-person associations between religiousness and perceived cosmic mattering.

The data for these studies were collected in the United States. Despite declining numbers of Christians and a growing group with no religious affiliation (Pew, 2019), the United States remains highly religious (compared with other wealthy countries) and majority Christian (Pew, 2018). This constitutes a limitation insofar as the links we have examined may vary depending on average levels of religiousness in a society and across religious groups. To illustrate, past research has found that religiousness is more strongly associated with life-satisfaction in regions with high average levels of religiousness (Diener et al., 2011; Okulicz-Kozaryn, 2010). The association between religiousness and perceived meaning may be similarly inflated in highly religious countries like the United States. Moreover, it's possible that religiousness supports a sense of cosmic mattering by encouraging specific kinds of

beliefs—for instance, that there is a God who cares about human beings and has a plan for their lives. Because the content of religious belief systems varies, this suggests that the link between religiousness and perceived cosmic mattering may also vary across religious groups. Perhaps monotheists interpret cosmic mattering as mattering to God, whereas non-monotheists would interpret it differently. To investigate these questions, future research would benefit from cross-national samples that highlight a wide range of religious traditions, as well as qualitative research on how individuals of different faiths (or no faith) interpret and respond to measures like the Perceived Cosmic Mattering Questionnaire.

Studies 3–5 employed online samples, which past research has found to be more diverse and to provide comparable or superior data-quality compared to undergraduate and community samples (Buhrmester et al., 2018; Hauser & Schwarz, 2016). Nevertheless, it may be valuable to replicate our findings in populations with limited access to and/or awareness of internet platforms used for online studies.

This investigation was, to our knowledge, the first to compare candidate explanations for the relationship between religiousness and perceived meaning in life. Yet, we have not exhausted the possibilities. For example, religion may also support perceived meaning in life by providing a stable worldview that supports a sense of coherence (Heintzelman et al., 2013; Park, 2005). Other research has found that religious practice is associated with positive emotions (Van Cappellen et al., 2021), which have themselves been found to promote perceived meaning (King et al., 2006). Future research may investigate these or other candidate mechanisms.

Future research may also benefit from zooming in on different aspects of religiousness. For instance, is “defensive” religiousness (Beck, 2004), characterized by simple and dogmatic

beliefs, more strongly associated with perceived cosmic mattering than other religious styles? Might a secure “attachment to God” (Beck & McDonald, 2004) amplify the link between religiousness and perceived cosmic mattering? *Non-religiousness* also comes in a variety of forms, which may impact our findings (Van Tongeren et al., 2021; Zuckerman et al., 2016).

### Implications and Conclusion

These results highlight the importance of the novel construct of perceived cosmic mattering. Some people feel significant, even in the context of an incomprehensibly vast universe. Many may consider this a “positive illusion” (Taylor & Brown, 1988)—fortifying, but nevertheless a fantasy. Yet those with religious faith may take these findings to demonstrate the distinctive role that religion can play in making life worth living. In the absence of religious faith, one could try to cultivate a sense of significance by contributing to science (i.e., attempting to comprehend the universe) or working to protect the Earth from climate change or other global threats. Yet, the impacts of such endeavors are likely to be at the comparatively humble scale of the planet, rather than the far vaster scale of the universe. Hence, insofar as religion is distinctively well-positioned to support perceived cosmic mattering, it may be a unique source of perceived meaning in life.



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**Table S1: Results of Six Multilevel Regressions with Terms for Experimental Condition – Study 1**

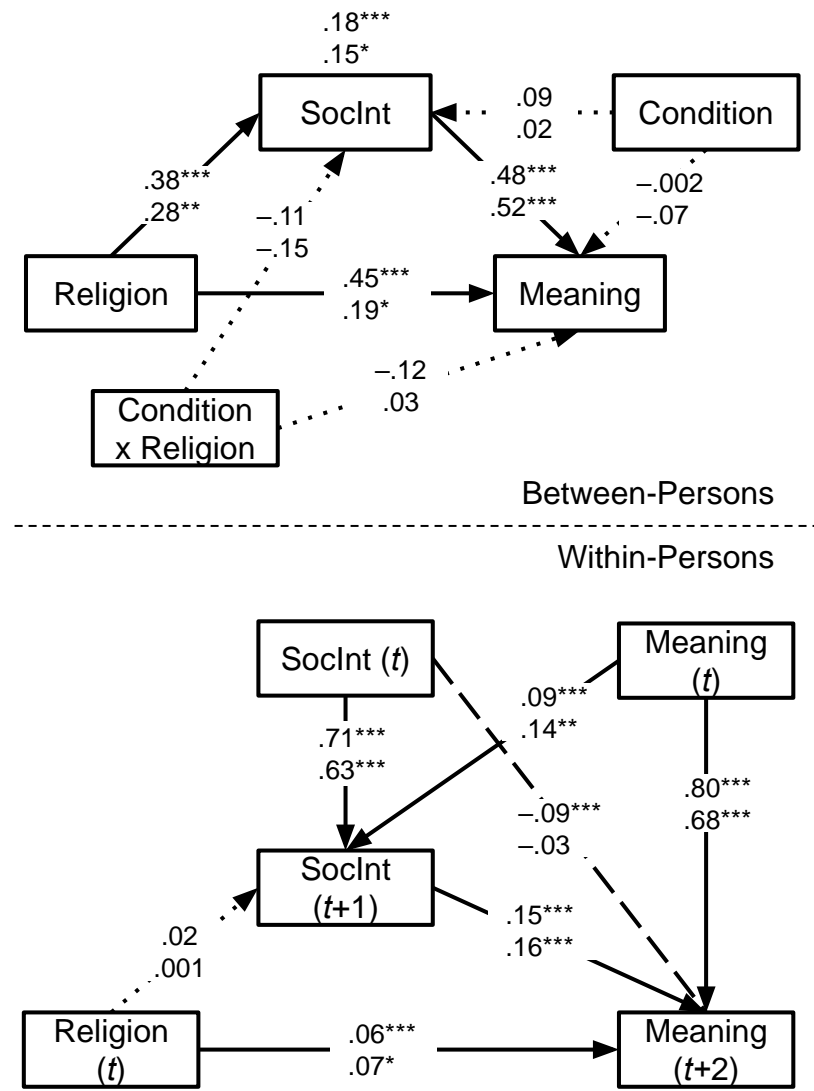
The table below reports the results of multilevel regression models that include terms for main effects of and interactions with experimental condition. We did not observe significant main effects in any model. We observed significant interactions in one of these six models (indicated by bolded text). We report these results in note 2 of the main text.

<i>Independent Variable</i>	<i>Nightly</i>			<i>Quarterly</i>		
	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>SE</i>	<i>p</i>
<b>Regressing Perceived Meaning on Religiousness</b>						
<i>PM of Religiousness (Between-Persons link)</i>	.47	.06	< .001	.54	.18	.003
<i>Deviation from PM of Religiousness (Within-Persons link)</i>	.38	.04	< .001	.57	.15	< .001
<i>Condition</i>	-.13	.12	.242	-.14	.17	.396
<i>Condition × PM of Religiousness</i>	-.16	.08	.067	-.30	.26	.247
<i>Condition × Deviation from PM of Religiousness</i>	-.10	.06	.105	-.06	.21	.761
<i>PM of Religiousness × Deviation from PM of Religiousness</i>	.03	.03	.319	-.004	.25	.989
<i>Condition × PM of Religiousness × Deviation from PM of Religiousness</i>	.04	.05	.388	.12	.38	.755
<b>Regressing Social Integration on Religiousness</b>						
<i>PM of Religiousness (Between-Persons link)</i>	.33	.08	< .001	.19	.06	.002
<i>Deviation from PM of Religiousness (Within-Persons link)</i>	.42	.05	< .001	.05	.09	.606
<i>Condition</i>	.07	.15	.632	.01	.07	.900
<i>Condition × PM of Religiousness</i>	-.14	.11	.221	-.11	.08	.193
<i>Condition × Deviation from PM of Religiousness</i>	<b>-.16</b>	<b>.08</b>	<b>.040</b>	-.10	.13	.440
<i>PM of Religiousness × Deviation from PM of Religiousness</i>	-.05	.04	.227	.01	.12	.946
<i>Condition × PM of Religiousness × Deviation from PM of Religiousness</i>	<b>.13</b>	<b>.06</b>	<b>.033</b>	-.09	.19	.627
<b>Regressing Perceived Meaning on Religiousness and Social Integration</b>						
<i>PM of Religiousness (Between-Persons link)</i>	.35	.05	< .001	.32	.13	.011
<i>Deviation from PM of Religiousness (Within-Persons link)</i>	.33	.04	< .001	.57	.17	.001
<i>PM of Social Integration (Between-Persons link)</i>	.41	.04	< .001	1.24	.14	< .001
<i>Deviation from PM of Social Integration (Within-Persons link)</i>	.19	.01	< .001	.43	.08	< .001
<i>Condition</i>	-.16	.10	.111	-.17	.14	.237
<i>Condition × PM of Religiousness</i>	-.12	.07	.094	.08	.18	.651
<i>Condition × Deviation from PM of Religiousness</i>	-.09	.06	.109	-.36	.25	.146
<i>PM of Religiousness × Deviation from PM of Religiousness</i>	.02	.03	.464	-.03	.23	.899
<i>Condition × PM of Religiousness × Deviation from PM of Religiousness</i>	.04	.04	.415	.08	.37	.808

Note. PM indicates “Person Mean”.

### Figure S1: Results of Two Multilevel Mediation Models with Terms for Experimental Condition – Study 1

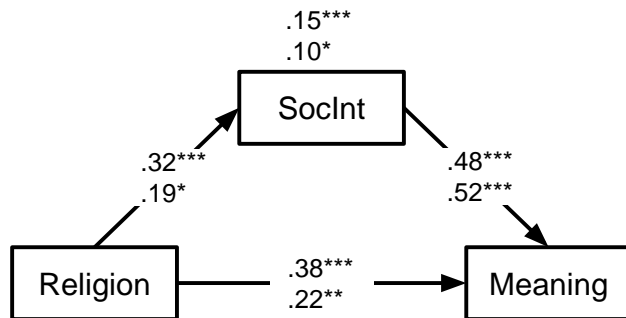
The figure below illustrates the results of the multilevel mediation models (for nightly and quarterly reports) when including terms for main effects of and interactions with experimental condition. Neither was significant and including versus excluding these terms does not change the pattern of results.



*Note.* Coefficients are fully standardized, with nightly results stacked on quarterly ones. Significant indirect paths are indicated above the mediator. The dashed line indicates a path that was significant in the nightly model, but not in the quarterly model. The dotted lines indicates paths that were not significant in either model.

**Figure S2: Results of Multilevel Mediation Model with Perceived Meaning at  $t + 1$  as an Additional Within-Persons Variable – Study 1**

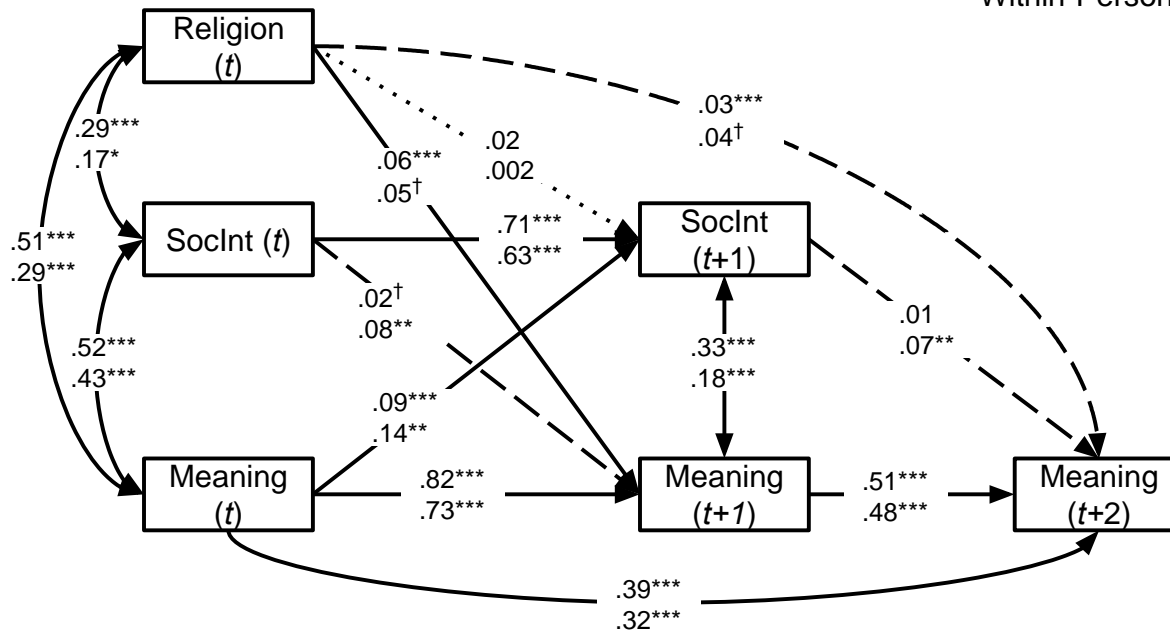
The models presented below are similar to the ones presented in Figure 2 in the main text. The only difference is the addition of perceived meaning at  $t + 1$ . The between-persons results are unchanged by this modification. Within-persons, the only notable difference from the models from the main text is that, in the quarterly analysis, the direct link between religion and meaning at  $t + 2$  is reduced to marginal significance ( $p = .052$ ). The link between religion and meaning at  $t + 1$  is also marginally significant ( $p = .055$ ). There was no change in the pattern of results from the nightly data.



*Note.* Coefficients are fully standardized, with nightly results stacked on quarterly ones. Significant indirect paths are indicated above the mediator. The dashed line indicates a path that was significant in the nightly model, but not in the quarterly model. The dotted line indicates a path that was not significant in either model.

Between-Persons

Within-Persons

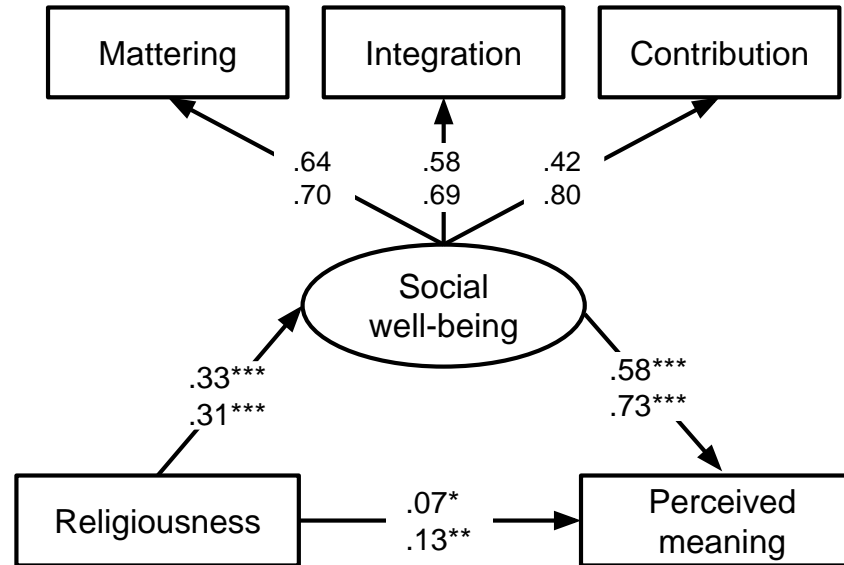


**Table S2: Means, Standard Deviations, and Correlations – Studies 2–3**

Variable	Study 2							Study 3	
	<i>M</i>	<i>SD</i>	1	2	3	4	5	<i>M</i>	<i>SD</i>
1. Religiousness	-0.01	0.87	–	.35** [.27, .43]	.19** [.10, .27]	.28** [.19, .36]	.23** [.14, .31]	0.00	0.87
2. Perceived Meaning	4.11	0.76	.26** [.21, .30]	–	.54** [.47, .60]	.50** [.43, .56]	.63** [.58, .69]	4.40	1.56
3. Social Mattering	3.27	0.56	.17** [.12, .22]	.42** [.37, .46]	–	.52** [.46, .59]	.54** [.47, .60]	2.68	0.79
4. Social Integration	0.00	0.75	.23** [.18, .28]	.30** [.25, .35]	.37** [.33, .42]	–	.55** [.49, .61]	4.01	1.58
5. Social Contribution	0.01	0.75	.15** [.10, .20]	.26** [.21, .30]	.23** [.18, .28]	.28** [.23, .33]	–	4.78	1.49

*Note.* The same measures were used across studies for perceived meaning in life (Meaning in Life Questionnaire – Presence), and social mattering (General Mattering Scale). However, the measures of religiousness, social integration, social contribution differed. See the main text for details.

**Figure S3: Social Well-Being Mediates the Link Between Religiousness and Perceived Meaning in Life – Studies 2-3**



*Note.* \* indicates  $p < .05$ ; \*\* indicates  $p < .01$ ; \*\*\* indicates  $p < .001$ . Coefficients for both studies are presented, with Study 2 on top. These models displayed good fit. For Study 2:  $\chi^2(4) = 30.40$ ,  $p < .001$ , CFI = .966, TLI = .915, Robust RMSEA = .066 (90% CI: .047, .091), SRMR = .023. For Study 3:  $\chi^2(4) = 15.71$ ,  $p = .003$ , CFI = .984, TLI = .959, Robust RMSEA = .080 (90% CI: .041, .123), SRMR = .025.

Table S3: Exploratory Factor Analysis of Mattering Scales – Study 4

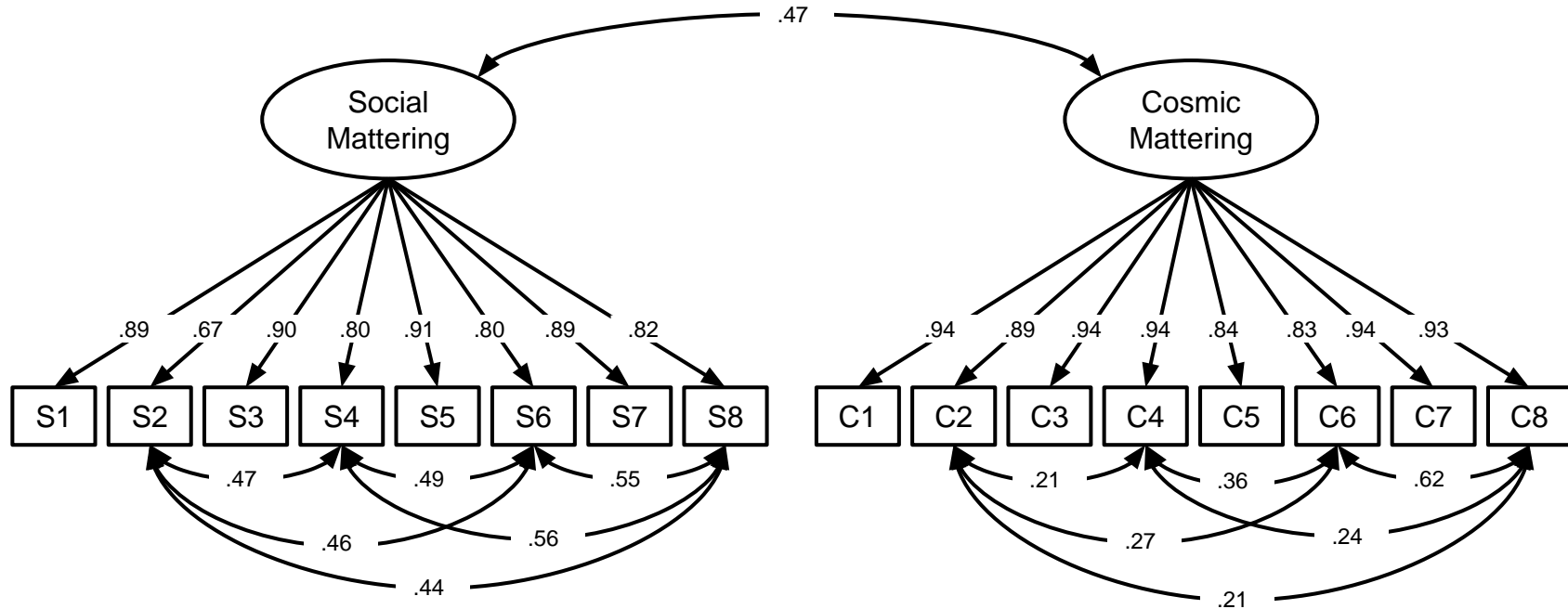
Exploratory Factor Analysis		
Item	Social	Cosmic
<i>Perceived Interpersonal Mattering Questionnaire</i>		
<b>My life matters to other people.</b>	.87	
I spend my time doing things that matter to others.	.67	.15
<b>My life is important to other people.</b>	.91	
The things I do are important to other people.	.88	
<b>Others consider my life worthwhile.</b>	.90	
Others consider my activities to be worthwhile.	.84	
<b>Others consider my life to have value and significance.</b>	.87	
The things I do have value and significance for other people.	.89	
<i>Perceived Cosmic Mattering Questionnaire</i>		
<b>My life matters in the grand scheme of the universe.</b>		.95
I spend my time doing things that matter in the grand scheme of the universe.		.90
<b>Even in the context of the cosmos, my life is important.</b>		.96
Even in the context of the cosmos, the things I do are important.		.96
<b>Despite the vast scale of the universe, my life is worthwhile.</b>		.80
Despite the vast scale of the universe, my activities are worthwhile.		.84
<b>My life has value and significance, in a cosmic context.</b>		.95
The things I do have value and significance, in a cosmic context.		.96

*Note.* Bolded text indicates the items that were retained in the measures used in Study 5. The exploratory factor analysis summarized above used a two-factor solution, with Promax rotation.



#### Figure S4: Confirmatory Factor Analysis of Mattering Scales – Study 4

We used the *lavaan* package in R (Rosseel, 2012) to run confirmatory factor analyses with robust (Huber-White) standard errors and a scaled test statistic. An initial model, in which the social and cosmic items indicated separate factors, did not show especially good fit:  $\chi^2(103) = 433.08$ ,  $p < .001$ ; CFI = .896; TLI = .879; RMSEA = .105; SRMR = .049. Modification indexes suggested that a source of misfit may have come from the fact that some items on the questionnaires referred to “my life,” whereas others referred to “my activities” or “the things I do.” Participants may have distinguished their activities from their “lives” in some more abstract sense. Allowing the “activities” items within each scale to covary with each other significantly improved model fit  $\Delta\chi^2(13) = 143.22$ ,  $p < .001$ , and led to good fit by absolute metrics:  $\chi^2(90) = 231.94$ ,  $p < .001$ ; CFI = .955; TLI = .940; RMSEA = .074; SRMR = .064. This final model is visualized below. Given this result, when we abbreviated these measures in Study 5, we used only the items that referred to “my life.”



**Table S4: Means, Standard Deviations, and Correlations – Study 4**

Variable	<i>M</i>	<i>SD</i>	1	2	3
1. Religiousness	-0.00	0.88			
2. Perceived Meaning in Life	5.26	1.30	.34** [.23, .43]		
3. Perceived Interpersonal Mattering	5.56	1.14	.24** [.13, .34]	.69** [.62, .74]	
4. Perceived Cosmic Mattering	4.45	1.78	.48** [.39, .56]	.78** [.73, .82]	.52** [.43, .60]

**Table S5: Exploratory and Confirmatory Factor Analyses of Mattering Scales – Study 5**

Item	Close	Community	Cosmic
<i>Perceived Close Others Mattering Questionnaire</i>			
My life matters to the people I'm close with.	.93		
My life is important to those who know me.	.92		
People close to me consider my life worthwhile.	.91		
Those who know me consider my life to have value and significance.	.93		
<i>Perceived Societal Mattering Questionnaire</i>			
My life matters to my society.		.83	
My life is important to my community.		.91	
My community considers my life worthwhile.		.96	
My society considers my life to have value and significance.		.97	
<i>Perceived Cosmic Mattering Questionnaire – Short Form</i>			
My life matters in the grand scheme of the universe.			.97
My life is important in the context of the cosmos.			1.01
Despite the vast scale of the universe, my life is worthwhile.			.73
My life has value and significance, even in a cosmic context.			.91

*Note.* Participants responded to all items using 7-point Likert scales (1 = “Strongly disagree”, 7 = “Strongly agree”). The exploratory factor analysis summarized above used a three-factor solution, with Promax rotation.

We also ran multi-group confirmatory factor analyses with robust (Huber-White) standard errors and a scaled test statistic. In the first, the close others, societal, and cosmic mattering items all indicated a single latent variable. In the second, the close others and societal items indicated one latent variable, whereas the cosmic items indicated another. In the third, each set of items indicated its own latent variable. Likelihood-ratio tests found that the two-factor model demonstrated significantly better fit than the one-factor model,  $\Delta\chi^2(2) = 258.87, p < .001$ , and that the three-factor model displayed still better fit,  $\Delta\chi^2(4) = 719.17, p < .001$ . The three-factor model also displayed good fit by absolute metrics:  $\chi^2(102) = 310.72, p < .001$ ; CFI = .960; TLI = .949; RMSEA = .080; SRMR = .035.

**Table S6: Means, Standard Deviations, and Correlations – Study 5**

Variable	Sample 1					Sample 2			
	M	SD	1	2	3	4	5	M	SD
1. Religiousness	2.69	1.27	–	.25** [.16, .34]	.11* [.01, .21]	.23** [.14, .32]	.35** [.26, .44]	2.27	1.40
2. Perceived Meaning	5.67	0.98	.31** [.19, .42]	–	.67** [.62, .73]	.67** [.61, .72]	.66** [.61, .72]	5.56	1.32
3. Perceived Close Others Mattering	6.32	0.86	.15* [.03, .27]	.53** [.44, .62]	–	.52** [.45, .59]	.43** [.35, .51]	6.22	0.96
4. Perceived Community Mattering	5.33	1.18	.12 [-.00, .24]	.58** [.49, .66]	.63** [.55, .70]	–	.64** [.58, .70]	4.94	1.55
5. Perceived Cosmic Mattering	4.43	1.70	.39** [.28, .49]	.50** [.40, .59]	.36** [.25, .46]	.50** [.40, .59]	–	4.74	1.93

### Re-Analyses Using Alternative Indexes of Religiousness

As indicated in the main text (footnote 2), several of our religiousness measures assessed three facets of the construct: “intrinsic” religiousness (self-rated importance of religion in one’s life); participation in public religious activities (e.g., attending worship services); and solitary religious activities (e.g., praying alone). Across studies, the measures showed a high degree of internal reliability, and breaking up standardized scales introduces concerns about measure reliability. (These recomputed religiousness scores were calculated from as few as one or as many as three items.) However, we wanted to ensure that we had not disadvantaged the Social Mattering Hypothesis by using measures that overemphasized non-social aspects of religiousness. Hence, we reran our analyses using the following alternative indexes of religiousness:

1. Intrinsic religiousness plus public activities (i.e., excluding any items assessing solitary activities)
2. Just intrinsic religiousness
3. Just public religious activities
4. Just solitary religious activities.

Below, we summarize and discuss the results of these re-analyses, organized by study.

### Study 1

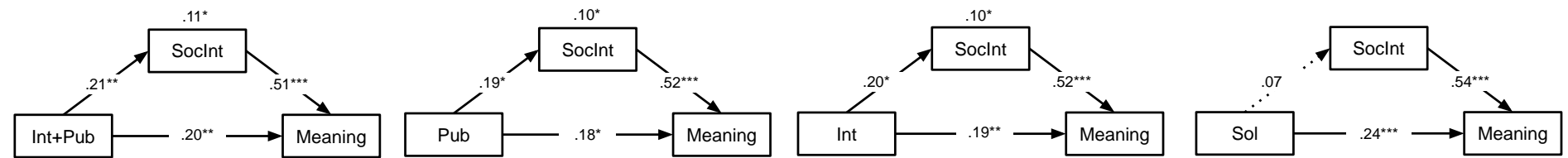
The nightly reports in Study 1 used a single-item measure of religiousness. However, the quarterly reports could be reanalyzed. Below are the results of multilevel regression models, in which perceived meaning in life was the dependent variable. With one exception (flagged with red text), the patterns of results were identical to those reported in the main text.

In Model 4 (where religiousness was indexed solely as time spent praying alone) the within-persons association with perceived meaning in life was non-significant when controlling for social integration. Curiously, we found the opposite pattern of results in the mediation models. Solitary religious activity was the only facet to show a direct within-persons link with perceived meaning (see below).

	<i>Predictor</i>	<i>b</i>	<i>SE</i>	<i>p</i>
<b>Model 1: Intrinsic religiousness &amp; public activities</b>				
	<i>Person-Mean of Religiousness (Between-Persons link)</i>	.36	.09	< .001
	<i>Deviation from Person-Mean of Religiousness (Within-Persons link)</i>	.44	.11	< .001
	<i>Person-Mean of Social Integration (Between-Persons link)</i>	1.24	.14	< .001
	<i>Deviation from Person-Mean of Social Integration (Within-Persons link)</i>	.40	.06	< .001
<b>Model 2: Intrinsic religiousness only</b>				
	<i>Person-Mean of Religiousness (Between-Persons link)</i>	.32	.08	< .001
	<i>Deviation from Person-Mean of Religiousness (Within-Persons link)</i>	.29	.09	.001
	<i>Person-Mean of Social Integration (Between-Persons link)</i>	1.27	.14	< .001
	<i>Deviation from Person-Mean of Social Integration (Within-Persons link)</i>	.40	.06	< .001
<b>Model 3: Public activities only</b>				
	<i>Person-Mean of Religiousness (Between-Persons link)</i>	.28	.08	< .001
	<i>Deviation from Person-Mean of Religiousness (Within-Persons link)</i>	.24	.07	< .001
	<i>Person-Mean of Social Integration (Between-Persons link)</i>	1.25	.14	< .001
	<i>Deviation from Person-Mean of Social Integration (Within-Persons link)</i>	.40	.06	< .001
<b>Model 4: Solitary activities only</b>				
	<i>Person-Mean of Religiousness (Between-Persons link)</i>	.31	.08	< .001
	<i>Deviation from Person-Mean of Religiousness (Within-Persons link)</i>	-.03	.07	.626
	<i>Person-Mean of Social Integration (Between-Persons link)</i>	1.34	.14	< .001
	<i>Deviation from Person-Mean of Social Integration (Within-Persons link)</i>	.40	.06	< .001

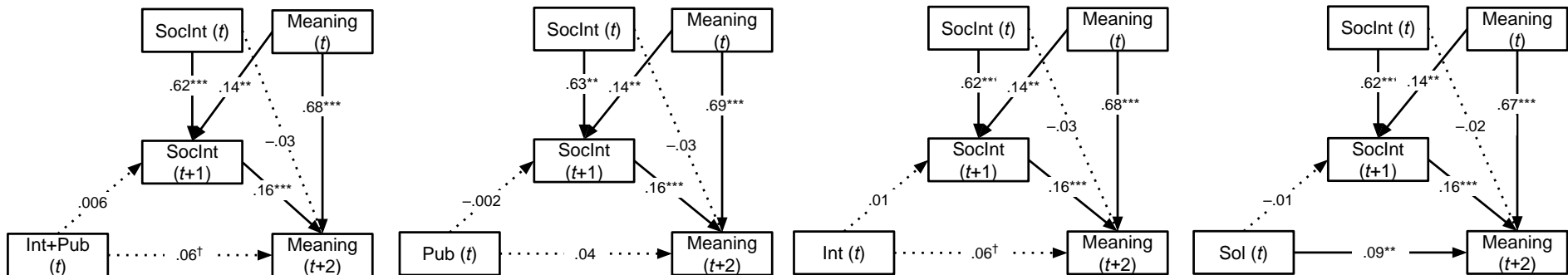
The figure below illustrates the results of four multilevel mediation models. The between-subjects results are consistent with those reported in the main text, except for those of the model in which religiousness was indexed solely by solitary religious activities (on the far right). Between-subjects, solitary religious activities were not related to social integration. However, the within-subjects results for this model match those of the model in which the entire religiousness measure was used.

In contrast, the direct path between religiousness and changes in perceived meaning was not significant in the other models (in which religiousness was indexed as intrinsic religiousness, engagement in public activities, or both). Hence, these results suggest that the within-subjects link between religiousness and perceived meaning is primarily due to the solitary aspects of religiousness. If so, this supports our argument that social factors play a smaller role than previously thought in explaining why religiousness can make life feel more meaningful.



Between-Persons

Within-Persons



Note. “Int” indicates intrinsic religiousness, “Pub” indicates public religious activities, “Sol” indicates solitary religious activities. † indicates  $p < .10$ ; \* indicates  $p < .05$ ; \*\* indicates  $p < .005$ ; \*\*\* indicates  $p < .001$ .

### Studies 2–3

The table below gives the results of mediation models from Studies 2–3. Differences from the results reported in the main text are flagged with red text.

In Study 2, we found no direct links between religiousness and perceived meaning in the models where the mediator was a social well-being latent variable and solitary activities were excluded from religiousness scores. These results could indicate that complex indexes of social well-being may fully explain the between-persons link between perceived meaning in life and the public and intrinsic aspects of religiousness. However, this conclusion is contradicted by the Study 3 re-analyses. There, we found significant direct links between these same indexes of religiousness and perceived meaning, even after accounting for the indirect path through social well-being. It's possible that this inconsistency results from the fact that Study 2 used several abbreviated and/or unstandardized measures. These post-hoc sensitivity analyses subdivide the measures even further, thus compromising measure reliability even further. In Study 3 we assessed all the same constructs with complete, psychometrically validated measures. This may explain the difference in the results of sensitivity analyses between studies.

The other difference from the results reported in the main text was that, in Study 3, social well-being did not significantly mediate the link between public religious activities and perceived meaning in life. This is surprising, given that the public activities are the most social aspect of religiousness. Hence, one would expect this facet of the construct to show the strongest links with social well-being. Assuming this it is not a spurious result produced by measurement issues, this further supports our argument that the Social Mattering Hypothesis is a limited explanation of the link between religiousness and perceived meaning in life.

	Study 2					Study 3				
	<i>b</i>	<i>CI</i>	<i>p</i>	$\beta$	%	<i>b</i>	<i>CI</i>	<i>p</i>	$\beta$	%
<b>Intrinsic religiousness &amp; public activities</b>										
<i>Model 1a: Mediation by social mattering</i>										
<i>Direct Path</i>	.14	[.100, .181]	< .001	.17	75%	.45	[.320, .574]	< .001	.26	73%
<i>Indirect Path</i>	.05	[.031, .065]	< .001	.06	25%	.17	[.083, .255]	< .001	.09	27%
<i>Total Association</i>	.19	[.143, .231]	< .001	.23	–	.62	[.473, .762]	< .001	.35	–
<i>Model 1b: Mediation by social well-being</i>										
<i>Direct Path</i>	<b>.03</b>	<b>[-.015, .078]</b>	<b>.157</b>	<b>.04</b>	<b>18%</b>	.22	[.079, .354]	.002	.13	36%
<i>Indirect Path</i>	.16	[.118, .199]	< .001	.19	82%	.40	[.267, .534]	< .001	.23	64%
<i>Total Association</i>	.19	[.149, .229]	< .001	.23	–	.62	[.470, .760]	< .001	.35	–
<b>Intrinsic religiousness</b>										
<i>Model 2a: Mediation by social mattering</i>										
<i>Direct Path</i>	.12	[.083, .157]	< .001	.16	75%	.40	[.275, .533]	< .001	.24	70%
<i>Indirect Path</i>	.04	[.025, .058]	< .001	.05	25%	.17	[.098, .253]	< .001	.10	30%
<i>Total Association</i>	.16	[.120, .202]	< .001	.21	–	.57	[.429, .716]	< .001	.34	–
<i>Model 2b: Mediation by social well-being</i>										
<i>Direct Path</i>	<b>.04</b>	<b>[-.009, .078]</b>	<b>.118</b>	<b>.05</b>	<b>21%</b>	.20	[.065, .323]	.003	.12	34%
<i>Indirect Path</i>	.13	[.093, .164]	< .001	.17	79%	.38	[.253, .515]	< .001	.23	66%



	<i>Total Association</i>	.16	[.122, .203]	< .001	.22	–	.57	[.412, .716]	< .001	.34	–
<b>Public activities</b>											
<i>Model 3a: Mediation by social mattering</i>											
	<i>Direct Path</i>	.12	[.083, .157]	< .001	.16	76%	.36	[.246, .475]	< .001	.23	83%
	<i>Indirect Path</i>	.04	[.022, .056]	< .001	.05	24%	.07	[-.002, .154]	.065	.05	17%
	<i>Total Association</i>	.16	[.117, .198]	< .001	.21	–	.43	[.312, .551]	< .001	.28	–
<i>Model 3b: Mediation by social well-being</i>											
	<i>Direct Path</i>	.03	[-.016, .069]	.237	.04	17%	.17	[.049, .392]	.007	.11	39%
	<i>Indirect Path</i>	.13	[.097, .173]	< .001	.18	83%	.27	[.156, .400]	< .001	.17	61%
	<i>Total Association</i>	.16	[.122, .198]	< .001	.21	–	.44	[.304, .556]	< .001	.28	–
<b>Solitary activities</b>											
<i>Model 4a: Mediation by social mattering</i>											
	<i>Direct Path</i>	.15	[.119, .191]	< .001	.19	74%	.34	[.199, .467]	< .001	.22	77%
	<i>Indirect Path</i>	.05	[.036, .071]	< .001	.06	26%	.10	[.025, .176]	.011	.06	23%
	<i>Total Association</i>	.21	[.168, .247]	< .001	.25	–	.43	[.312, .551]	< .001	.28	–
<i>Model 4b: Mediation by social well-being</i>											
	<i>Direct Path</i>	.07	[.021, .106]	.003	.08	32%	.16	[.038, .272]	.008	.10	36%
	<i>Indirect Path</i>	.14	[.104, .181]	< .001	.25	68%	.28	[.147, .420]	< .001	.18	64%
	<i>Total Association</i>	.21	[.166, .246]	< .001	.25	–	.44	[.304, .556]	< .001	.28	–

*Note.*  $b$  and  $\beta$  indicate, respectively, the unstandardized and standardized coefficients. *CI* indicates the 95% confidence interval around the unstandardized coefficient. % indicates the proportion of the total association explained by a given path. In the “a” models the mediator was social mattering (assessed using the General Mattering Scale). In “b” models the mediator was a latent variable indicated by perceived social integration, contribution, and mattering.

**Study 4**

Below are results of mediation models, using recomputed indexes of religiousness, from Study 4. In each case, the pattern of results was identical to the results reported in the main text.

	<i>b</i>	<i>CI</i>	<i>p</i>	$\beta$	%
<b>Intrinsic religiousness &amp; public activities</b>					
<i>Direct Path</i>	-.05	[-.155, .047]	.303	-.04	–
<i>Indirect Path via Perceived Social Mattering</i>	.14	[.082, .204]	< .001	.10	25%
<i>Indirect Path via Perceived Cosmic Mattering</i>	.43	[.327, .548]	< .001	.30	75%
<i>Total Association</i>	.52	[.378, .656]	< .001	.36	–
<b>Intrinsic religiousness only</b>					
<i>Direct Path</i>	-.05	[-.149, .052]	.348	-.03	–
<i>Indirect Path via Perceived Social Mattering</i>	.13	[.074, .198]	< .001	.10	26%
<i>Indirect Path via Perceived Cosmic Mattering</i>	.40	[.305, .513]	< .001	.29	74%
<i>Total Association</i>	.49	[.346, .626]	< .001	.35	–
<b>Public activities only</b>					
<i>Direct Path</i>	-.04	[-.115, .038]	.317	-.04	–
<i>Indirect Path via Perceived Social Mattering</i>	.10	[.047, .152]	< .001	.07	23%
<i>Indirect Path via Perceived Cosmic Mattering</i>	.30	[.213, .397]	< .001	.23	77%
<i>Total Association</i>	.35	[.215, .483]	< .001	.27	–
<b>Solitary activities only</b>					
<i>Direct Path</i>	-.06	[-.154, .027]	.186	-.04	–
<i>Indirect Path via Perceived Social Mattering</i>	.11	[.051, .167]	< .001	.08	24%
<i>Indirect Path via Perceived Cosmic Mattering</i>	.34	[.250, .462]	< .001	.24	76%
<i>Total Association</i>	.39	[.257, .548]	< .001	.27	–

*Note.* *b* and  $\beta$  indicate, respectively, the unstandardized and standardized coefficients. *CI* indicates the 95% confidence interval around the unstandardized coefficient. % indicates the proportion of the total association explained by a given path. The pairwise comparisons between the indirect paths were significant in each case (all *ps* < .001).

## Partial Post-Hoc Power Analyses

In these partial post-hoc power analyses, we aimed to determine the smallest effect sizes that our studies were adequately (i.e., 80%) powered to detect. We ran these analyses using the *simr* (Green & MacLeod, 2016) and *simsem* packages (Pornprasertmanit et al., 2012) in R, both of which use the Monte Carlo method. The code used in these analyses is available on OSF: <https://osf.io/uwyr3/>.

### Study 1

For the multilevel regression models, we used the “powerSim” function in the *simr* package. This function takes a fitted lmer object (i.e., a multilevel regression model) and tests for power to detect fixed or random effects of a specified size. We tested for power to detect within- and between-person links between religiousness and perceived meaning while controlling for social integration. Each analysis started with a baseline model that included all predictors except for the one we were testing, and then examined the power our samples provided to detect the added effect of the relevant term.

In the nightly reports the simulations indicated approximately 80% power to detect a between-persons effects as small as  $\beta = .13$  (observed coefficient was  $\beta = .36, p < .001$ ), and a within-persons link as small as  $\beta = .03$  (observed coefficient was  $\beta = .12, p < .001$ ). In the quarterly reports, the simulations indicated approximately 80% power to detect a between-persons effect as small as  $\beta = .14$  (observed coefficient was  $\beta = .21, p < .001$ ), and a within-persons effect as small as  $\beta = .04$  (observed coefficient was  $\beta = .05, p < .001$ ).

We did not conduct power analyses for the multilevel mediation models, as we were unable to find packages in R with appropriate functions for such analyses. (The *simsem* package used for power analyses in Studies 2-5 does not handle multilevel structural equation models.)

### Studies 2-3

For Studies 2-3, we ran partial post-hoc power analyses on the mediation models using the “sim” function in *simsem*. We aimed to identify the smallest indirect effect for which our sample provided at least 80% power. In these analyses, all path coefficients must be set in advance. We set all coefficients to be equal. These simulations indicated that we had approximately 80% power to detect indirect paths as small as  $\beta = .002$  in Study 2 ( $N = 1,501$ ), and  $\beta = .03$  in Study 3 ( $N = 479$ ). The observed indirect effects were substantially larger:  $\beta = .09$  in Study 2 and  $\beta = .16$  in Study 3.

### Study 4

For Study 4, we used the same analytic technique as in Studies 2-3, except that we examined the *two* parallel mediators simultaneously. The simulations indicated that the sample of  $N = 301$  provided approximately 80% power to detect the two indirect paths if those paths were as small as  $\beta = .04$ . The observed indirect paths were substantially larger:  $\beta = .09$  for perceived social mattering and  $\beta = .29$  for perceived cosmic mattering.

### Study 5

For Study 5 we again used the same analytic technique, except that we examined the *three* parallel mediators simultaneously. The simulations indicated that Sample 1 ( $N = 252$ ) provided approximately 80% power to detect all three indirect paths if those paths were as small as  $\beta = .04$ . The observed indirect effects were comparable or larger:  $\beta = .08, .04,$  and  $.04$  for perceived cosmic mattering, close others mattering and community mattering respectively. Sample 2 ( $N = 387$ ) provided approximately 80% power to detect indirect effects as small as  $\beta = .03$ . The observed indirect effects were all larger:  $\beta = .11, .04,$  and  $.06$  for perceived cosmic mattering, close others mattering and community mattering respectively.