Title
Religiosity Change and its Effects on Personality

Author
Lenhausen, Madeline

Publication Date
2022

Peer reviewed|Thesis/dissertation

Religiosity Change and its Effects on Personality

By

MADELINE ROWENA LENHAUSEN
DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Psychology

in the

OFFICE OF GRADUATE STUDIES

of the

UNIVERSITY OF CALIFORNIA

DAVIS

Approved:

Christopher J. Hopwood, Chair

Wiebke Bleidorn

Richard W. Robins

Committee in Charge

2022

Acknowledgements

When I was 11 years old, I wrote my first ever acknowledgement section for a research project on a South American country of your choice. I wrote:

"I acknowledge this to my mom and my teachers. Sometimes it was really hard to research something and since my mom is ABSOLUTLY great with computers she helped me find what I needed. ALL my teachers helped me out with any questions I had for my project. If I needed any opinions I could ask them. THANKS FOR EVERYTHING IT WAS REALLY HELPFUL!"

Not much is different between those acknowledgments and the acknowledgements I want to make now, aside from knowing how to spell 'absolutely' and the fact that my mom did not do any of my research for me. And the only reason I am fortunate enough to be sitting here writing this acknowledgment section is because of all the support, guidance, and encouragement I received from so many people along the way. And to those people, I'd like to "acknowledge this" to you.

Wiebke. My biggest of thank yous goes to you. I don't think I can fully put into words how grateful I am to have had you as my mentor. I super appreciate all of your time that you dedicated to my work and growth in graduate school. You have taught me perceptiveness, precision, persistence, and countless other valuable skills that will transcend beyond school. Thank you to my committee members Rick and Chris, for being on my committees and giving helpful feedback. Rick, your discussions in journal club and insight into my work often challenged me to think in new and improved ways. Chris, your guidance and confidence in me is truly one of the main reasons I'm here today.

Big thank you to Ted who embodied the perfect blend of academic guidance and friendship. To all my friends: thank you. For the laughs. The words. The late nights and the early mornings. And everything in between.

Last but certainly not least, I'd like to thank my family – grandparents, parents, aunts, uncles, cousins. The whole lot of you. Thank you, Mom, for the unconditional love and support you've always given me. You've been my #1 fan and believed in me when I needed it most. Thank you, Grandma, for your patience, your care, your time. All of my writing you've edited and feedback you've given me on my ideas built the foundation that prepared me for graduate school without me even realizing it at the time. And thank you to all my cousins that are more like my siblings – I've never felt alone in this world having all of you by my side.

When I was 11 years old, I wrote my first ever acknowledgements section, full of indignation. Because it was required. Because I didn't know how to thank people. Because I just wanted the research project to be done already so I could go play. Now at 25 years old, I am writing this acknowledgements section full of immense gratitude and contentment (partly because this acknowledgment section isn't required, so I didn't have to write this if I didn't want to). But mostly because it really shows the community of great people I was surrounded by who all contributed toward this end goal in some way or another. THANKS FOR EVERYTHING IT WAS REALLY HELPFUL!

Abstract

Religion is not as popular or widespread in the world as it was decades ago. Despite this ongoing worldwide secularization trend, individual differences in religiosity are still prevalent and associated with a variety of psychological variables. In particular, individual differences in religiosity both predict and are predicted by individual differences in personality. Given the influence religion has on identity, politics, and society, it is important to understand changes over time in religiosity amidst secular declines and how these changes impact personality.

This dissertation consists of two chapters. In Chapter 1, I analyzed religiosity development across the lifespan while controlling for ongoing secularization trends using longitudinal data from over 14,000 Dutch participants aged 16 to 101 years. Results from a series of mixed growth curve models indicated that religiosity increases across the lifespan, with no evidence for age-graded decreases in religiosity after controlling for secularization. Increases were most pronounced during middle to late adulthood and moderated by education, such that college-educated individuals were less religious and experienced less pronounced age-graded increases in their religious beliefs. In Chapter 2, I investigated between- and within-person associations between religiosity and the Big Five personality traits in a sample of over 12,000 Dutch individuals across 11 years. Results from random intercept cross-lagged panel models (RI-CLPM) at the between-person level indicated religiosity was associated with higher levels of agreeableness and conscientiousness, and lower levels of emotional stability, extraversion, and openness. At the within-person level, when people experienced an increase in agreeableness and/or extraversion relative to their usual levels, they tended to subsequently believe more strongly in God than usual, and this effect was bidirectional for agreeableness. Between-person associations were moderated by gender and religious upbringing. Religiosity was negatively

associated with extraversion for women and positively associated with agreeableness and conscientiousness for men; people who grew up in a religious family had a stronger negative association between religiosity and openness. Taken together, results from both studies show that religion is still pervasive and influential on personality despite worldwide declines in religiosity.

Table of Contents

Chapter 1

Changes in religiosity across the lifespan

Cite: Bleidorn, W., Lenhausen, M. R., Schwaba, T., Gebauer, J. E., & Hopwood, C. J. (in press). Secularization Trends Obscure Developmental Changes in Religiosity. *Social Psychological and Personality Science*

Introduction

Individual differences in religiosity are not static but develop over time (Dillon & Wink 2007). Social scientists have studied the development of religiosity for decades (Hites, 1965). The extant research provides a rough picture of the lifespan trajectory of religiosity, with most studies pointing to plummeting levels in young adulthood, increasing levels during middle adulthood, and peak levels during late adulthood. However, most existing studies did not account for prevailing secularization trends that may bias or obscure age-graded changes in religiosity (Newport, 2019). Religiosity is among the psychological variables that undergo massive historical changes (Swatos & Christiano, 1999). It is critically important to account for these changes when modeling lifespan changes in religiosity. In the present study, we disentangle developmental changes in religiosity from secularization trends using 11-wave longitudinal data from over 14,000 Dutch participants aged 16 to 101 years.

Religiosity Across the Lifespan

Young adulthood has been frequently associated with dramatic declines in religiosity (Desmond, 2010). In Western societies, most "emerging adults" leave the parental home after high school. This change of residence appears to coincide with significant shifts in values and religious beliefs (Arnett & Jensen, 2002). College experiences may further spur emerging adults' desire to explore different worldviews and novel activities, driving them farther away from previously held religious beliefs and activities. Existing research has partly supported the theorized decreases in religiosity during emerging adulthood (Chan et al., 2015). For example, Stoppa and Lefkowitz (2010) found significant declines in college students' religious service attendance. However, in contrast to theoretical predictions, religious beliefs remained stable in this sample. Desmond (2010) also found significant declines in religious service attendance

among U.S. youth. In this sample, religious beliefs also decreased over time, but these decreases were less dramatic than those observed for service attendance.

There are reasons to expect religiosity to rebound in middle adulthood. As people marry and settle down, they often invest in roles that are connected with religious institutions and values. The few studies that have tracked religiosity in middle adulthood provided mixed evidence for this hypothesis, with some reporting increases in religiosity (McCullough et al., 2005) and others finding religiosity to be stable (Hayward & Krause, 2013) or decrease during this life stage (Dillon & Wink, 2007).

As individuals grow closer to the end of life, religious activities are thought to serve as important meaning-making processes and coping strategies (Idler, 2006). On the other hand, age-graded declines in physical health may hinder older adults' ability to participate in religious activities (Benjamins, 2004). Existing studies provided no conclusive evidence for late-life changes in religiosity, with some reporting increasing levels up until old age (Bengston et al., 2015), some indicating stable levels (Courtenay et al., 1992), and others finding decreases, particularly among the oldest old (Idler et al., 2001).

Secularization Trends

Theory and existing research make a strong case for a curvilinear lifespan trajectory of religiosity, with dramatic declines in young adulthood, increasing levels during middle and late adulthood, and potential declines in old age. Conclusive evidence for this trajectory would provide a solid foundation on which theorists and researchers can develop their understanding of the mechanisms driving developmental changes in religiosity.

However, there is one issue that potentially undermines the conclusions that can be drawn from existing research. Over the past 50 years, most Western societies have been growing less

religious over time (Bruce, 2002; Johansloo & Gebauer, 2020; Swatos & Christiano, 1999). These well-documented secularization trends affect all ages and may - if not explicitly modeled - obscure age-graded changes in religiosity.

Thus, accounting for secularization trends may challenge previous conclusions concerning religious development (Wink et al., 2019). For instance, the sharp declines in young adults' religiosity may partly reflect secularization trends. Similarly, age-graded increases in religiosity during middle and late adulthood might have been obscured or canceled out by secularization effects. Several studies have attempted to disentangle age from secularization effects on religious development; however, most of these studies were constrained by their use of repeated cross-sectional data (e.g., Hayward & Krause, 2015, Twenge et al., 2015). Few longitudinal studies have accounted for secularization trends when charting religious development across the lifespan (for an example, see Bengston et al., 2016) The first goal of the present study was thus to separate the effects of age (i.e., development) and time (i.e., secularization) to draw a more precise picture of lifespan changes in religiosity in a large and nationally representative sample of the Netherlands.

Moderators of Religiosity Development

Normative changes in religiosity do not imply that everyone changes in the same way. People differ in their individual religiosity trajectories. For instance, although most young adults appear to decrease in religiosity, some remain stable or increase in their religious activities and beliefs (Chan et al., 2015).

What drives individual differences in religiosity development? Here, we examined the moderating effects of variables that have been theorized to predict individual differences in religiosity across the lifespan: gender (McCullough, 2005), educational attainment (Arnett &

Jensen, 2002), religious background (Petts, 2009), and health (Benjamins, 2004). Consistent with previous research, we expected men, college-educated individuals, and people without a religious upbringing to be less religious on average, more prone to secularization trends, and less prone to age-graded increases across the lifespan. We further expected changes in subjective and functional health to track with decreases in religious activities in old adulthood.

The Present Study

We used longitudinal data from a nationally representative sample of the Netherlands to disentangle age-graded changes in religiosity from secularization trends. Historically, the Netherlands has been a Christian country, with a strong Protestant majority up until the late 19th Century. Since then, there has been a steady decline in Christianity. Today, roughly half of the population report no religious affiliation, 45% are Christians, and 5% Muslim (https://www.cbs.nl/nl-nl/publicatie/2019/22/trends-in-nederland-2019). Against the backdrop of this increasingly secular Western culture, we examined age-graded changes in three measures of religiosity: belief in God, religious service attendance, and praying. Dissociating developmental changes across these measures will refine our understanding of religiosity development, ascertain the role of secularization, and contribute novel information about the processes underlying lifespan changes in religiosity in a secular culture.

Method

Data came from the Longitudinal Internet Studies for the Social Sciences (LISS) panel, which includes 11 annual assessments of religiosity in a nationally representative sample of over 14,000 Dutch individuals (Scherpenzeel et al., 2010). Since 2008, LISS participants have completed annual online surveys on various topics including religious practices and beliefs. Refreshment cohorts are regularly added to LISS to maintain sample representativeness. Some

authors of this study have used LISS data in previous studies to examine the development of personality traits (e.g., Schwaba & Bleidorn, 2018), values (Bleidorn et al., 2020) and self-esteem (Bleidorn & Schwaba, 2018; Bleidorn et al., 2021). None of these studies have analyzed changes in religiosity (http://dataarchive.lissdata.nl/publications).

Participants

We included participants from all LISS cohorts (2008, 2010, 2012, and 2014) who responded at least once to at least one of three religiosity items described below. The final sample consisted of 14,348 participants aged 16 to 101 years (M_{age} = 45.61, SD_{age} = 16.06 in 2008). The sample was 53.7% female and 59.14% had a college degree. At the first assessment wave in 2008, 53% of the participants reported no affiliation with a church; 42% were affiliated with a Christian church (18.99% Roman Catholic, 9.84% Protestant, 6.32% Dutch Reformed Church, 2.91% Reformed Churches in the Netherlands, 4.30% other Christian denominations), 2.16% were Muslim, and 1% reported affiliations with other religions. The sample sizes varied across assessment waves and measures (see Table 1).

Measures

Religiosity

We used three items to assess individual differences in religiosity across 11 annual waves from 2008 to 2019. Two of these items – "*Aside from special occasions such as weddings and funerals, how often do you attend religious gatherings nowadays?"* and "*Aside from when you attend religious gatherings, how often do you pray?"* focused on religious behavior and practices. Participants responded to these items on a 7-point Likert scale (0 = every day - 6 = never). Responses were reverse coded so that 0 indicated never and 6 indicated every day. The third item focused on participants' religious beliefs *"Which of the following statements best*

matches your idea of God?" Participants responded to this item on a 6-point Likert scale (0 = *I do not believe in God* - 5 = *I believe without any doubt that God exists*).

Moderators

We examined the effects of gender (0 = male, 1 = female), educational attainment, and religious background as time-invariant moderators. Participants' highest educational attainment was included as a dichotomous variable (0 = no college, 1 = college). Participants' religious background was assessed at baseline through the item *"When you were 15 years old, did your parents consider themselves members of a certain religion or church community?"* (0 = no, 1 = yes).

We examined participants' subjective and functional health as time-varying moderators. Subjective health was assessed at each wave (except in 2014) using the item "*How would you describe your health, generally speaking?"* (1 = poor to 5 = excellent). Functional health was assessed at each wave except in 2014 through three items: 1) *"To what extent did your physical health or emotional problems hinder your daily activities over the past month, for instance in going for a walk, walking up-stairs, dressing yourself, washing yourself, visiting the toilet?"* 2) "*To what extent did your physical health or emotional problems hinder your social activities over the past month, such as visiting friends and acquaintances?*" 3) *"To what extent did your physical health or emotional problems hinder your work over the past month, for instance in your job, the housekeeping, or in school?".* Participants responded to these items at each assessment wave on a 5-point Likert scale (1 = not at all to 5 = very much). Responses were reverse coded so that 1 indicated poor functional health and 5 indicated excellent functional health. We used these items to compute an overall functional health score at each assessment wave (internal consistencies ranged from α = .86 - .91; ω_h = .87 - .92).

Analyses

We ran a series of mixed growth curve models (Ferrer et al., 2004; Raudenbush & Bryk, 2002) to separate the effects of age (i.e., development) and time (i.e., secularization) on changes in the three religiosity measures. We computed each individual's exact age per assessment wave by subtracting the birth date from the interview date. Time was scaled as single-unit change in assessment wave. For each of the three religiosity measures, we started with an intercept-only (no growth) model and used stepwise model building strategies to identify the change model that fit the data best. To compare the fit of nested models, we used the Bayesian Information Criterion (BIC). To account for the large number of tests, we interpreted *p*-values <.001 as indicating significant effects. All analyses were conducted in R (R core team, 2020) using the packages lme4 (Bates et al., 2015), nlme (Pinheiro et al., 2021), and psych (Revelle, 2017). All analysis scripts are available at https://osf.io/zgf7v/

We first compared a no growth model to a linear age-based growth curve model that can be written as

$$Y[t]_n = y_{0n} + y_{s1n} \cdot \text{age}[t]_n + e[t]_n, \quad (1)$$

at Level 1, where $Y[t]_n$ is the observed religiosity score of person n at time t, $y0_n$ is the latent initial level religiosity score of person n, $\text{age}[t]_n$ is the observed age of person n at time t, y_{1s} is a latent slope representing age-graded changes in religiosity of person n across, and $e[t]_n$ is the latent error score of person n at time t. This model includes sources of individual differences in the level and slope, which can be expressed as

$$y_{0n} = \mu_0 + e_{0n},$$

$$ys_{1n} = \mu_{s1} + e_{s1n}, \quad (2)$$

at Level 2, where the level and age slope have fixed group means (μ_0, μ_{s1}) and residuals (e_{0n}, es_{1n}), and these residuals have variance components (σ^2_0, $\sigma^2 s_1$). We then extended this model to polynomial models that consider different nonlinear age functions (i.e., quadratic, cubic). Finally, to separate aging processes from secularization trends, we included a term that captures changes in religiosity across assessment waves. The full model can be written as

$$Y[t]_n = y_{0n} + y_{s1n} \cdot \text{age}[t]_n + y_{spn} \cdot \text{age}^p[t]_n + y_{swn} \cdot \text{wave}[t]_n + e[t]_n, \quad (3)$$

at Level 1, where $Y[t]_n$ is the observed religiosity score of person n at assessment time t, $y0_n$ is the latent initial level religiosity score of person n, age$[t]_n$ is the observed age of person n at time t, y_{1s} is a latent slope representing linear age-graded changes in religiosity of person n, age$^p[t]_n$ is the age basis of power p, y_{spn} a latent polynomial component score of person n, wave$[t]_n$ represents the effects of unit change in assessment wave on person n at time t, y_{s2} is a latent slope, representing change in religiosity across assessment waves for person n, and $e[t]_n$ is the latent error score of person n at time t. Again, this model includes sources of individual differences in the level and slopes, which can be expressed at Level 2 as

$$y_{0n} = \mu_0 + e_{0n},$$

$$ys_{1n} = \mu_{s1} + e_{s1n},$$

$$ys_{pn} = \mu_{sp} + e_{spn},$$

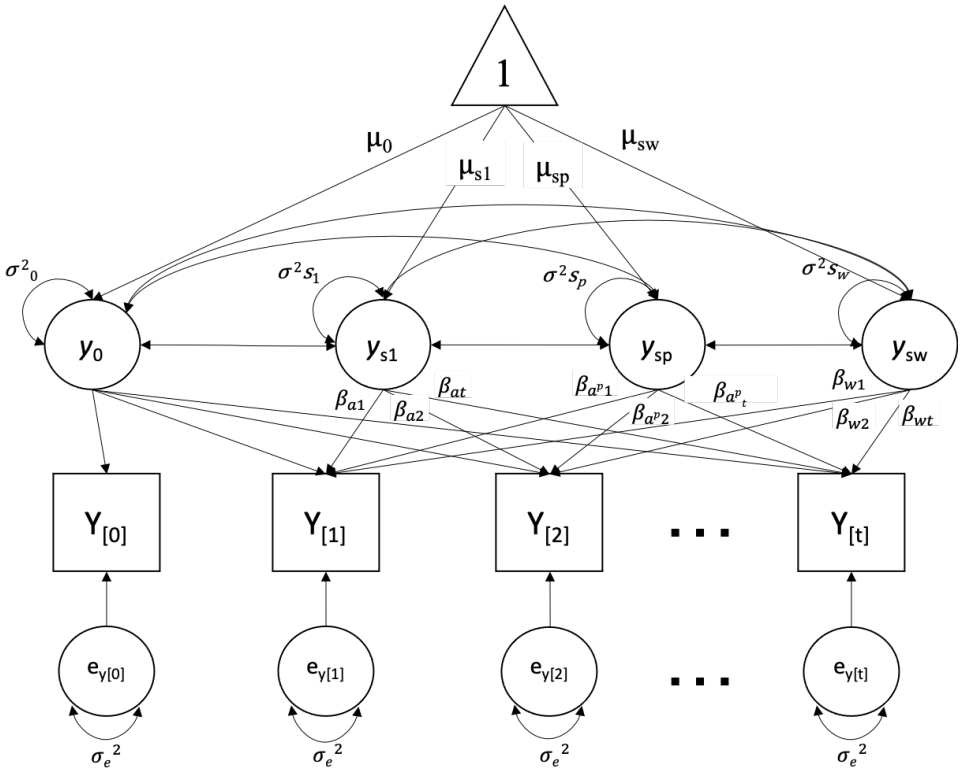
$$ys_{wn} = \mu_{sw} + e_{swn}, \quad (4)$$

where the intercept, age, and wave slopes have fixed group means (μ_0, μ_{s1}, $\mu_{sp,}$ μ_{sw}) and residuals (e_{0n}, es_{1n}, es_{pn}, and es_{wn}), and these residuals have variance components (σ^2_0, $\sigma^2 s_1$, $\sigma^2 s_{p,}$ $\sigma^2 s_w$). According to this model (see Figure 1), change in religiosity (Y) can be described as a function of two processes: an age-based growth process (i.e., average change in religiosity per year) and a secularization trend (i.e., average change in religiosity per unit change in assessment wave). As a

final step, we included each of the moderator variables. Specifically, time-invariant moderators (e.g., gender) were included as covariates at Level 2 and time-variant moderators (e.g., subjective health) at Level 1. Continuous moderators were z-standardized with $M = 0$ and $SD = 1$.

Figure 1

Path diagram of a latent growth model with two processes



Note. Y*[t]* score at time *t;* y_0 = intercept; y_{s1} = linear age slope; y_{sp} = quadratic age slope, y_{sw} = wave slope; $e_{y[t]}$ error; 1 constant; β_a = basis coefficients for age; β_w = basis coefficients for wave; μ = means; σ^2 = variances.

Results

Table 1 shows the sample sizes and descriptive statistics for the three religiosity measures at each of the 11 assessment waves. Correlations among the three variables across all waves are available at https://osf.io/zgf7v/.

Table 1

Sample sizes and descriptive statistics per assessment wave

	Belief in God		Religious gatherings		Prayer	
Wave	*N*	*M (SD)*	*N*	*M (SD)*	*N*	*M (SD)*
1	7401	2.47 (1.82)	7383	1.07 (1.47)	7363	1.85 (2.38)
2	5790	2.46 (1.83)	5765	1.12 (1.51)	5739	1.97 (2.43)
3	6199	2.41 (1.84)	6157	1.08 (1.51)	6134	1.93 (2.43)
4	5644	2.36 (1.83)	5587	1.07 (1.51)	5575	1.91 (2.43)
5	6138	2.27 (1.83)	6089	1.01 (1.49)	6062	1.81 (2.40)
6	5897	2.18 (1.83)	5845	1.00 (1.49)	5828	1.76 (2.38)
7	6180	2.15 (1.83)	6125	0.96 (1.46)	6112	1.70 (2.36)
8	6090	2.13 (1.83)	6062	0.97 (1.46)	6047	1.68 (2.34)
9	5585	2.10 (1.83)	5535	0.93 (1.44)	5523	1.64 (2.32)
10	6313	2.10 (1.84)	6260	0.95 (1.45)	6254	1.64 (2.34)
11	5574	2.06 (1.83)	5529	0.90 (1.41)	5523	1.59 (2.30)

Age- and Occasion-Based Mixed Growth Curve Models

As a starting point, we ran a series of age-based mixed models to identify the age function that best described the different religiosity indicators over time. These models included a model of no growth, a linear age model (with age grand-mean centered at 49.76 years), a quadratic age model, and a cubic age model. Model comparison tests indicated that quadratic age-based growth models with random intercepts and slopes fit the data best for all three religiosity indicators (see Table S1 in the supplemental online materials [SOM] for a comparison of all model BICs). We then extended these models to age- and occasion-based mixed growth

models (see equation 3). For all three religiosity measures, adding a random linear slope that captured change across assessment waves significantly improved model fit. Table 2 presents the parameter estimates of the best-fitting age- and occasion-based mixed growth models.

Table 2

Best-Fitting Age- and Occasion-Based Mixed Growth Model Parameters for Three Religiosity Indicators

Parameter	Belief in God			Religious gatherings			Prayer		
	μ	95% CI	σ^2	μ	95% CI	σ^2	μ	95% CI	σ^2
Intercept	2.534	[2.496, 2.572]	2.832	1.057	[1.026, 1.087]	1.882	1.900	[1.850, 1.950]	5.220
Age	0.013	[0.012, 0.015]	0.000	0.008	[0.006, 0.009]	0.001	0.020	[0.018, 0.022]	0.001
Age^2	0.000	[0.000, 0.000]	0.000	0.000	[0.000, 0.000]	0.000	0.000	[0.000, 0.000]	0.000
Wave	-0.060	[-0.064, -0.057]	0.006	-0.028	[-0.031, -0.025]	0.005	-0.053	[-0.058, -0.049]	0.014

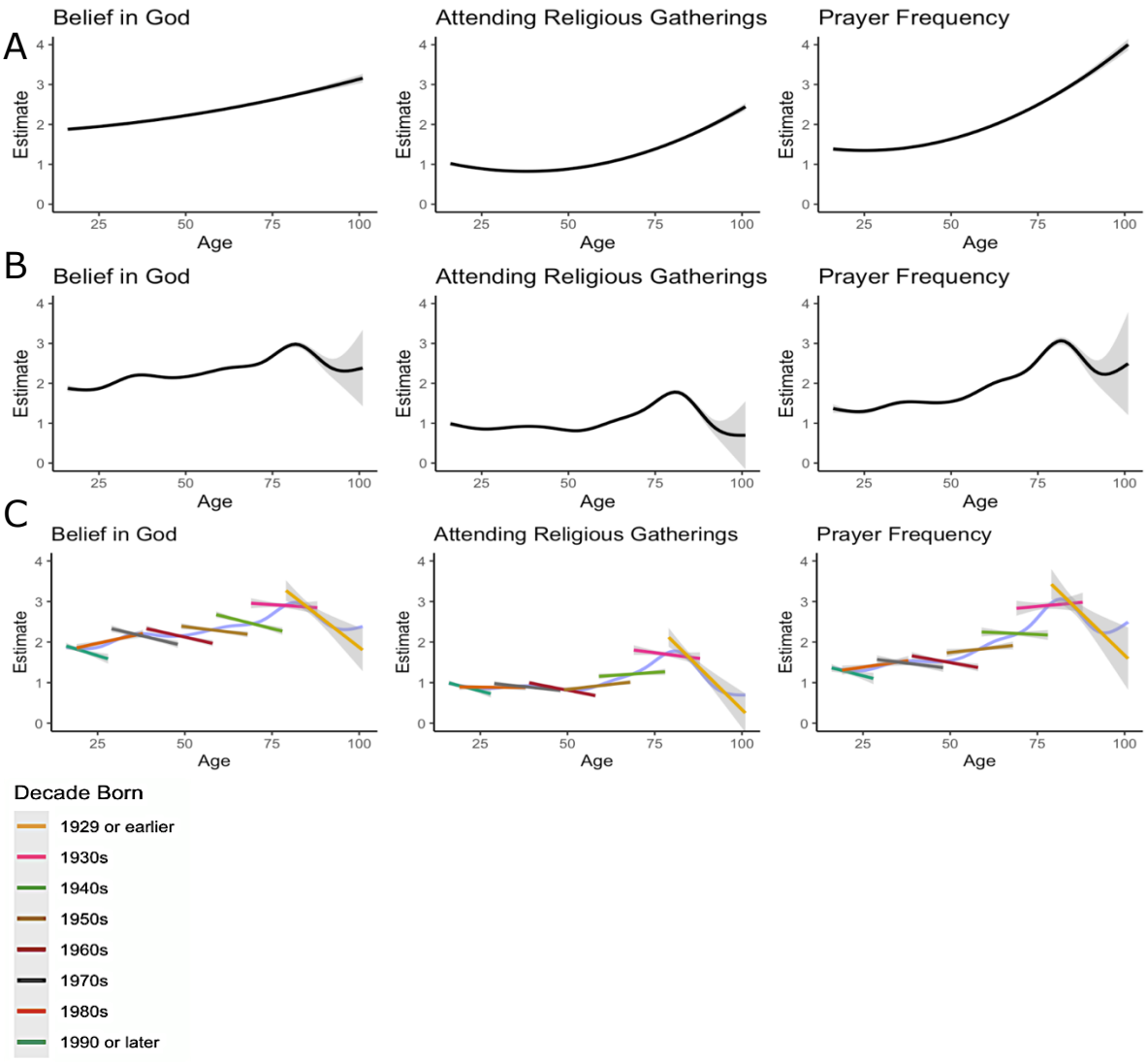
Note. μ = fixed effects, σ^2= random effects. Quadratic age effects had values <.000. All fixed effects were significant at p <.001, except the quadratic age effect for *Belief in God* which was significant at p <.01. Significance of random effects was indicated by an improvement in model fit upon inclusion of these terms. These effect sizes are reported as variances.

Results indicated similar lifespan trajectories for the three religiosity measures, with age-graded increases over the course of adulthood up until old age (see Figure 2A) and peak-levels around age 80 years. The significant linear age effects (μ_{s1} = 0.01 - μ_{s1} = 0.02) suggested that religious beliefs and behaviors increased by this amount per year across the adult lifespan, with significant individual differences in development. The small but significant quadratic age effects indicated that most of the age-graded changes occurred in middle to late adulthood (~age 55-80), again with individual differences in change across individuals. Overall, the magnitude of total age-graded increases in the three religiosity measures from ages 16 to 80 years corresponded to medium-sized effects (Cohen's *d*s: 0.36 - 0.57).

The significant random wave effects (μ_{sw}= -0.03 - -0.06) indicated that religious beliefs and behaviors decreased by this amount from wave to wave with significant individual

Figure 2

Lifespan Religiosity Trajectories



Note. Model-implied age-graded trajectories (Panel A), LOESS smoothed raw data (Panel B), and effects of age and wave across eight age groups (Panel C) for three religiosity indicators. Belief in God was assessed on a 0-5 scale; attendance of religious gatherings and prayer on 0-6 scales. Solid lines capture the average trajectories, grey areas cover the 95% confidence intervals.

differences around this trend. Across the three religiosity measures, the magnitude of these secularization trends corresponded to small to medium-sized effects (Cohen's *ds:* |0.13| - |0.25|). Illustrating the different contributions of age and time to people's lifespan religiosity development, Panel C of Figure 2 visualizes the changes in the three religiosity indicators across assessment waves for eight different age groups.

Moderators of Lifespan Religiosity Development

We estimated the effects of time-invariant and time-variant covariates on overall religiosity levels and their interactions with age and time (see Table 3). Consistent with previous research, we found significant main effects of gender on the intercepts of all three religiosity measures, suggesting that women expressed stronger beliefs in God, attended religious gatherings more often, and prayed more frequently than men did. In addition, we found significant interaction effects between education and age, indicating that college-educated individuals experienced less pronounced increases in belief in God over the course of adulthood. Results indicated a similar interaction effect for praying as well as smaller interaction effects between educational attainment and wave; however, these effects did not meet our strict significance level of $p < .001$. To illustrate, Figure 3 visualizes the lifespan trajectories of belief in God for individuals with and without a college degree.

.

Table 3

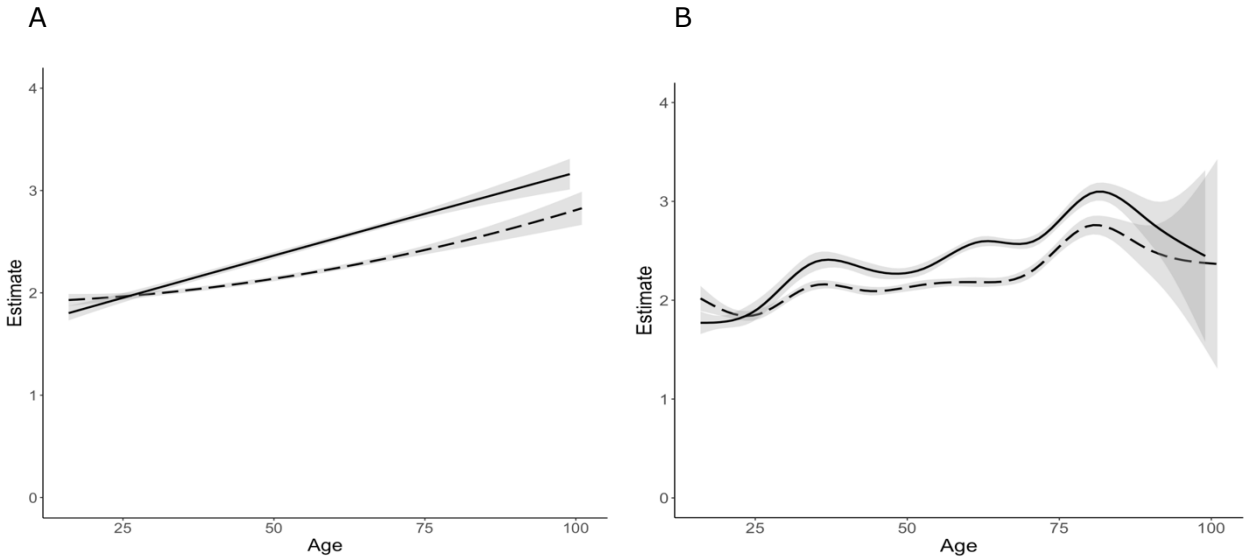
Effects of Covariates on Growth Curve Parameters from Age- and Occasion-Based Mixed Models for Belief in God, Attendance of Religious Gatherings, and Praying

Covariate	Intercept			Age			Age^2			Wave		
	β	95% CI	*p*	*β*	95% CI	*p*	*β*	95% CI	*p*	*β*	95% CI	*p*
Belief in God												
Gender	**0.375**	**[0.301, 0.449]**	**< .001**	0.001	[-0.002, 0.004]	.658	0.000	[-0.000, 0.000]	.659	-0.004	[-0.011, 0.003]	.249
F. health	-0.025	[-0.043, -0.006]	.008	0.000	[-0.000, 0.001]	.269	0.000	[0.000, 0.000]	.044	-0.001	[-0.004, 0.002]	.523
S. health	-0.021	[-0.041, -0.002]	.033	0.000	[-0.000, 0.001]	.147	0.000	[-0.000, 0.000]	.073	0.000	[-0.003, 0.003]	.941
Rel. back.	-0.011	[-0.088, 0.066]	.778	-0.003	[-0.006, 0.000]	.064	-0.000	[-0.000, 0.000]	.238	0.001	[-0.006, 0.008]	.820
College	**-0.235**	**[-0.314, -0.155]**	**< .001**	**-0.007**	**[-0.010, -0.004]**	**< .001**	0.000	[-0.000, 0.000]	.153	0.009	[0.002, 0.016]	.015
Religious Gatherings												
Gender	**0.107**	**[0.048, 0.167]**	**< .001**	0.002	[-0.001, 0.005]	.127	0.000	[-0.000, 0.000]	.776	-0.003	[-0.008, 0.003]	.335
F. health	-0.010	[-0.023, 0.004]	.161	0.000	[-0.000, 0.001]	.315	0.000	[-0.000, 0.000]	.074	0.001	[-0.001, 0.003]	.611
S. health	0.006	[-0.008, 0.020]	.407	0.000	[-0.000, 0.001]	.223	0.000	[0.000, 0.000]	.008	-0.001	[-0.003, 0.001]	.288
Rel. back.	0.002	[-0.060, 0.064]	.953	0.000	[-0.002, 0.003]	.773	-0.000	[-0.000, 0.000]	.768	-0.002	[-0.008, 0.003]	.426
College	-0.005	[-0.069, 0.059]	.882	-0.002	[-0.005, 0.001]	.123	0.000	[-0.000, 0.000]	.760	0.003	[-0.003, 0.009]	.268
Praying												
Gender	**0.455**	**[0.359, 0.550]**	**< .001**	0.003	[-0.001, 0.007]	.118	-0.000	[-0.000, 0.000]	.695	-0.011	[-0.020, -0.003]	.010
F. health	-0.024	[-0.044, -0.004]	.018	0.000	[-0.000, 0.001]	.543	-0.000	[-0.000, 0.000]	.473	0.003	[-0.000, 0.006]	.085
S. health	-0.000	[-0.022, 0.021]	.973	-0.000	[-0.001, 0.001]	.932	0.000	[-0.000, 0.000]	.087	-0.000	[-0.003, 0.003]	.810
Rel. back.	-0.010	[-0.110, 0.090]	.848	-0.002	[-0.007, 0.002]	.288	-0.000	[-0.000, 0.000]	.834	0.001	[-0.008, 0.009]	.900
College	-0.090	[-0.195, 0.015]	.091	-0.007	[-0.011, -0.003]	.002	-0.000	[-0.000, 0.000]	.190	0.009	[-0.001, 0.018]	.066

Notes. F. health = Functional health, S. health = Subjective health, Rel. back. = Religious background. Significant effects in bold (p = <.001)

Figure 3

Lifespan Religiosity Trajectory Moderated by Education



Note. Model-implied lifespan trajectory (A) and LOESS smoothed lifespan trajectory (B) of Belief in God for people with (dashed line) and without (solid line) a college degree.

Discussion

How do people's religious beliefs and behaviors change over the course of adulthood? In this 11-wave longitudinal study, we separated developmental changes in three measures of religiosity - belief in God, religious service attendance, and praying - from secularization trends to draw a more precise picture of the lifespan trajectory of religiosity in a large, nationally representative sample from the Netherlands.

Results indicated that the average trajectory of all three religiosity measures was best captured by a quadratic curve, with increases over the course of adulthood and peak levels at about age 80 years. Consistent with national and international polling data (https://news.gallup.com/poll/1690/religion.aspx), we also found evidence for a significant secularization trend. That is, the average Dutch person in our sample experienced significant decreases in religiosity between 2008 and 2019.

As expected, not all individuals followed these average trends. Consistent with previous research (Jensen & Arnett, 2002; McCullough et al., 2005), men and college-educated individuals were generally less religious. Moreover, age-graded increases in belief in God were less pronounced in college-educated individuals compared to individuals without college education. In contrast to our predictions, religious background and health were unrelated to overall levels or changes in religiosity.

Implications of Findings

The present findings provide important insights into the effects of age and time on religious beliefs and behaviors in a secular culture like the Netherlands. By taking into account secularization trends, we identified a different trajectory of lifespan changes in religiosity than previous studies have. Four findings stand out.

First, in contrast to studies that emphasized the loss of religion among adolescents and young adults (e.g., Desmond, 2010; Hayward & Krause, 2013), we found no evidence for age-graded decreases in religiosity during emerging adulthood. When taking secularization effects into account, emerging adults were relatively stable or even increased in their religious beliefs and behaviors over the course of young adulthood (Twenge et al., 2015). In other words, observed decreases in religiosity were completely explained by secularization trends in the present sample.

Second, the quadratic trajectories indicate that most of the age-graded changes in religiosity occur during middle and late adulthood. The enhanced focus on religious beliefs and behavior in middle adulthood is consistent with lifespan developmental theories that emphasize the self-transcending and reflective focus of this life stage (Freund & Baltes, 2002; McAdams, 2001). These findings also correspond with findings on personality development in middle

adulthood. Changes that typically occur during this life stage tend to reflect growth towards social maturity and adjustment (Roberts et al., 2006; Schwaba et al., 2021), as indicated by increases in conscientiousness and agreeableness – traits that have been found to be consistently related to religiosity (Entringer et al., 2021; Gebauer et al., 2014; Saroglou, 2010).

Third, the present results shed more light on religiosity development in late adulthood. Consistent with Pascal's wager and psychological theories that consider religious beliefs and behaviors as important strategies to cope with late-life challenges (Idler, 2006), we found significant increases in religiosity up until old age. A closer inspection of change among the oldest old suggests potential declines as people approach the end of their life. However, the relatively small sample of adults older than 85 and limited information about sample mortality precluded a more precise estimation of end-of-life changes in religiosity.

Fourth, with one exception, there was little evidence for moderators of lifespan changes in religiosity. Supporting previous research that found negative links between higher education and religiosity (Desmond, 2010), we found college-educated individuals to be less religious and experience less pronounced age-graded increases in their religious beliefs.

Limitations

We note some important limitations to this study. We focused on three core aspects of the religious experience; however, there may be other components of religiosity that were not covered in the present study. The generalizability of the present findings is further constrained by the moderate time period of the study (2008-2019) and the culture in which it was conducted. The Netherlands is among the most secularized Western countries and has seen accelerated secularization trends over the past decades. More longitudinal research on religiosity on samples from diverse countries and cultures is needed to gauge the generalizability of the present

findings. More research is also needed to address these fundamental questions about the causes of the age-graded changes in religiosity.

Conclusion

Do young adults lose their religion as they grow up? Is middle adulthood a time of religious rebound? At what age do people peak in their religious beliefs and behaviors? By separating developmental processes from secularization trends in a nationally representative sample from the Netherlands, the present study provides strong evidence for age-graded increases in religiosity up until old age. These age-graded changes must be understood in the context of prevailing secularization trends as indicated by significant decreases in religious beliefs and behaviors among people of all ages. Whether these trends generalize to other cultures than the Netherlands remains a question for future research.

References

Arnett, J. J., & Jensen, L. A. (2002). A congregation of one: Individualized religious beliefs among emerging adults. *Journal of Adolescent Research*, *17*, 451-467.

Bates, D., Mächler, M., Bolker, B., Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, 67, 1–48.

Bengtson, V. L., Silverstein, M., Putney, N. M., & Harris, S. C. (2015). Does religiousness increase with age? Age changes and generational differences over 35 years. *Journal for the Scientific Study of Religion*, *54*, 363-379.

Benjamins, M. R. (2004). Religion and functional health among the elderly: is there a relationship and is it constant?. *Journal of Aging and Health*, *16*, 355-374.

Bleidorn, W. & Schwaba, T. (2018). Retirement is associated with change in self-esteem. *Psychology and Aging, 33,* 586-594.

Bleidorn, W., Schwaba, T., Denissen, J.J.A., & Hopwood, C.J. (2021). Charting self-esteem during marital dissolution. *Journal of Personality, 98*, 9-22.

Bleidorn, W., Schwaba, T., & Hopwood, C.J. (2020). Health adversity and value change. Social Psychological and Personality Science, 12, 248-257

Bruce, S. (2002). God is dead: Secularization in the West (Vol. 3). Oxford: Blackwell.

Chan, M., Tsai, K. M., & Fuligni, A. J. (2015). Changes in religiosity across the transition to young adulthood. *Journal of Youth and Adolescence*, *44*, 1555–1566.

Courtenay, B. C., Poon, L. W., Martin, P., Clayton, G. M., & Johnson, M. A. (1992). Religiosity and adaptation in the oldest-old. *International Journal of Aging and Human Development*, *34*, 47–56.

Desmond, S. A., Morgan, K. H., & Kikuchi, G. (2010). Religious development: How (and why) does religiosity change from adolescence to young adulthood? *Sociological Perspectives*, *53*, 247–270.

Dillon, M., & Wink, P. (2007). *In the course of a lifetime: Tracing religious belief, practice, and change*. Univ of California Press.

Entringer, T. M., Gebauer, J. E., Eck, J., Bleidorn, W., Rentfrow, P. J., Potter, J., & Gosling, S. D. (2020). Big Five facets and religiosity: Three large-scale, cross-cultural, theory-driven, and process-attentive tests. *Journal of Personality and Social Psychology*. https://doi.org/10.1037/pspp0000364

Ferrer, E., Salthouse, T. A., Stewart, W. F., & Schwartz, B. S. (2004). Modeling age and retest processes in longitudinal studies of cognitive abilities. *Psychology and Aging, 19,* 243-##.

Freund, A. M., & Baltes, P. B. (2002). Life-management strategies of selection, optimization and compensation: Measurement by self-report and construct validity. *Journal of Personality and Social Psychology, 82,* 642-662.

Gebauer, J. E., Bleidorn, W., Gosling, S. D., Rentfrow, P. J., Lamb, M. E., & Potter, J. (2014). Cross-cultural variations in big five relationships with religiosity: A sociocultural motives perspective. *Journal of Personality and Social Psychology, 107*, 1064-1091.

Hayward, R. D., & Krause, N. (2013). Patterns of change in religious service attendance across the life course: Evidence from a 34-year longitudinal study. *Social Science Research*, *42*, 1480-1489.

Hites, R. W. (1965). Change in religious attitudes during four years of college. *The Journal of Social Psychology, 66,* 51-63.

Idler, E. (2006). Religion and aging. In *Handbook of Aging and the Social Sciences* (pp. 277-300). Academic Press.

Idler, E. L., Kasl, S. V., & Hays, J. C. (2001). Patterns of religious practice and belief in the last year of life. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *56*, S326-S334.

Joshanloo, M., & Gebauer, J. E. (2020). Religiosity's nomological network and temporal change: Introducing an extensive country-level religiosity index based on Gallup World Poll Data. *European Psychologist, 25,* 24-40

McCullough, M. E., Enders, C. K., Brion, S. L., & Jain, A. R. (2005). The varieties of religious development in adulthood: A longitudinal investigation of religion and rational choice. *Journal of Personality and Social Psychology, 89*, 78-89.

Newport, F. (2019). *Millennials' religiosity amidst the rise of the nones.* Gallup. https://news.gallup.com/opinion/polling-matters/267920/millennials-religiosity-amidst-rise-nones.aspx

R Core Team. (2020). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.R-project.org/

Revelle, W. R. (2017). *psych: Procedures for Personality and Psychological Research*.

Saroglou, V. (2010). Religiousness as a cultural adaptation of basic traits: A five-factor model perspective. *Personality and Social Psychology Review, 14*, 108-125.

Scherpenzeel, A. (2011). Data Collection in a Probability-Based Internet Panel: How the LISS Panel Was Built and How It Can Be Used. *Bulletin of Sociological Methodology/Bulletin de Méthodologie Sociologique, 109,* 56–61.

Schwaba, T. & Bleidorn, W. (2018). Individual differences in personality change across the adult lifespan. *Journal of Personality, 86,* 450-464.

Schwaba, T., Bleidorn, W., Hopwood, C. J., Manuck, S., & Wright, A. G. C (in press). Refining the maturity principle of personality development by examining facets, close others, and co-maturation. *Journal of Personality and Social Psychology.*

Stoppa, T. M., & Lefkowitz, E. S. (2010). Longitudinal changes in religiosity among emerging adult college students. *Journal of Research on Adolescence*, *20*, 23–38.

Swatos, W. H., & Christiano, K. J. (1999). Secularization theory: The course of a concept. *Sociology of Religion 60,* 209–228.

Twenge JM, Exline JJ, Grubbs JB, Sastry R, Campbell WK (2015) Generational and Time Period Differences in American Adolescents' Religious Orientation, 1966–2014. *PLoS ONE 10(5):* e0121454. https://doi.org/10.1371/journal.pone.0121454 pmid:25962174

Wink, P., Dillon, M., & Farina, D. (2019). Religion, spirituality, and the agential self. In D. P. McAdams, R. L. Shiner, & J. L. Tackett (Eds*.), Handbook of personality development (pp. 364–379).* The Guilford Press.

Supplemental Material

Table S1

Model Fit (Bayesian Information Criterion) of All Estimated Mixed Growth Curve Models

Model	Belief in God	Religious attendance	Prayer frequency
Null	271200	240029	302775
Random Effects: Intercept			
Age	197323	154023	209117
Age + Age^2	197304*	154030	209127
Age + Age^2 + Age^3	197309	154004*	209121*
Age + Age^2 + [Age^3] + Wave	195544	153298	207997
Random Effects: Intercept, Age			
Age + Wave	195267	152498	206564
Age + Age^2 + Wave	195291	152495	206563
Age + Age^2 + Age^3 + Wave	195327	152509	206592
Random Effects: Intercept, Age, Wave			
Age + Wave	**194388**	151103	204502
Age + Age^2 + Wave	194409	**151068**	**204479**
Age + Age^2 + Age^3 + Wave	194444	151100	204514

Note. "Random Effects: XX", where XX denotes the random effects included in the model. In models with only random effects of intercept, Wave was added as a predictor to the best fitting (lowest BIC) Age polynomial model denoted with an asterisk (*). Wave was included as a predictor in all remaining models. Overall best fitting models as indicated by lowest BIC are in bold.

Chapter 2

Changes in religiosity predict changes in personality

Cite: Lenhausen, M.R., Schwaba, T., Gebauer, J.E., Entringer, T.M., & Bleidorn, W. (under review). Transactional Effects Between Personality and Religiosity.

Introduction

Understanding an individual's personality provides valuable insight into their thoughts, feelings, and behaviors – whereas understanding an individual's religiosity can provide insight into how they find purpose and meaning in life. Cross-sectional associations between personality traits – especially agreeableness and conscientiousness – and religiosity have been well established, often marked by small-to-moderate positive associations (Ashton & Lee, 2021; Saroglou, 2010). Less attention has been given to the longitudinal associations between personality traits and religiosity over time. The few existing longitudinal studies have almost exclusively focused on the effects of personality traits on religiosity over time (e.g., Gebauer et al., 2014; Heaven & Ciarrochi, 2007; Schnitker et al., 2021) rather than the longitudinal effects of religiosity on personality. Moreover, most existing studies – longitudinal and cross-sectional – have focused on the association between personality and religiosity at the between-person level (Entringer et al., 2022; Huuskes et al., 2013; Wink et al., 2007). These studies have contributed to our understanding of the association between personality and religiosity between people. However, not even a single study to date has examined the intraindividual links between religiosity and personality traits over time. It thus remains unknown whether individuals who change in their religious involvement also tend to experience subsequent changes in their personality, and vice versa.

The purpose of the current study was to address this gap in the literature. To do this, we examined the reciprocal *within-person* effects between the Big Five personality traits – emotional stability, extraversion, openness, agreeableness, and conscientiousness (John et al., 2008) – and three aspects of religiosity (belief in God, service attendance, and prayer) across 11 annual assessments in a nationally representative sample of over 12,000 Dutch adults. We further

examined if the longitudinal associations between personality and religiosity were moderated by age, gender, or religious upbringing.

Personality and Religiosity

Personality can be defined as an individual's relatively stable patterns of thoughts, feelings, and behaviors (Allport & Odbert, 1936). The most commonly used model for understanding and assessing personality is the Big Five model. The Big Five capture individual differences in personality while providing a well-calibrated balance between conceptual breadth and descriptive fidelity (John et al., 2008).

Religiosity can be broadly defined as an individual's degree of sacred connectedness to some transcendent reality or being (Hill & Wood, 1999). Although religiosity can be understood as a single dimension and has often been assessed with single-item measures (Entringer et al., 2022; Gebauer et al., 2013, 2014; Inglehart et al., 2014), researchers have emphasized the multifaceted nature of religiosity and advocated the use of multidimensional assessments to fully capture individual differences in religiosity (King & Boyatzis, 2004; Saroglou, 2011; Stoppa & Lefkowitz, 2010). Here, we focus on three aspects of religiosity: belief in God, service attendance, and prayer. Together, these three variables roughly encompass all aspects of religiosity: belief in God captures the cognitive nature of religiosity, service attendance captures the behavioral, and prayer captures both emotional and behavioral (Saroglou et al., 2020).

Cross-Sectional Links Between Personality and Religiosity

Theory and some existing research suggested links between personality and religiosity because most religions, and their corresponding practices and communities, provide people with the opportunity to express and embrace certain personality traits (Allport, 1950; see also Eck & Gebauer, 2021; Gebauer et al., 2014). Of the Big Five traits, agreeableness and conscientiousness

have been theorized to have the strongest and most consistent associations with religiosity (Saroglou, 2010).

People who are high in agreeableness tend to show concern for others and are generally more likely to engage in prosocial behavior than people who are low in this trait. Agreeable people may thus be particularly drawn to religious ideas and institutions given that all major religions praise prosocial and frown upon antisocial behavior (e.g., the 10 Commandments and Parable of the Good Samarithan in Christianity; Zakat (tithing) in Islam; Dharma in Hinduism, The Eightfold Path in Buddhism). Devoting oneself to religion may, in turn, also act to increase agreeableness, given that a substantial amount of religious text and ritual encourages agreeable behavior (e.g., "Be kind and compassionate to one another, forgiving each other, just as in Christ God forgave you." – Ephesians 4:32).

People who are high in conscientiousness tend to be responsible, organized, and rule-following, potentially predisposing them to adhere to religious norms and practices, whereas people who are low in conscientiousness may have a harder time abiding by a religious routine (Maslow, 1964; McCullough et al., 2005). Moreover, many religions encourage self-discipline and control to their followers, which may serve to increase conscientiousness (e.g., "By effort and heedfulness, discipline and self-mastery, let the wise one make for himself an island which no flood can overwhelm." – Dhammapada 2:25).

Consistent with the theoretical predictions described above, agreeableness and conscientiousness have been commonly associated with religiosity in empirical studies (Aghababaei, 2014; Cerasa et al., 2016; Kosek, 1999; Löckenhoff et al., 2009; Lodi-Smith & Roberts, 2007; McCullough et al., 2003; McCullough & Willoughby, 2009). In a meta-analytic review of 71 samples across 19 different countries, Saroglou (2010) found that agreeableness and

conscientiousness were positively associated with religiosity, and concluded that personality is a core predictor of individual differences in religiosity. More recent studies have found this effect to be particularly strong in religious versus secular communities and societies (Ashton & Lee, 2019; Gebauer et al., 2014).

Evidence for links between religiosity with openness, extraversion, and emotional stability, on the other hand, is more mixed (Saroglou, 2002). There is some evidence to suggest that openness plays a role in people's religious involvement, however, this effect appears to be a function of people's cultural and religious context. Specifically, people high in openness have been found to be more attracted to religious ideas and communities in secular rather than religious societies (Ashton & Lee, 2019; Gebauer et al., 2014; Ludeke & Carey, 2015). This may be because people who are high in openness tend to be curious, unconventional, and may be generally more likely to rebel against sociocultural norms than people low in this trait (Eck & Gebauer, 2021; Entringer et al., 2021).

Extraverted people may be particularly attracted to the social aspects of the religious experience. People who are high in this trait tend to be social and outgoing and have thus been theorized to be more likely to attend social events including religious gatherings than introverted people (Löckenhoff et al., 2009). Evidence for this hypothesis have been mixed, with some studies finding small positive links and others finding no association between extraversion and religiosity (Ashton et al., 2021; Saroglou, 2002).

People who are low in emotional stability (i.e., high in neuroticism) tend to experience more negative affect and are more likely to experience depression and anxiety compared to people high in this trait. Engaging in religious practices may be a strategy for people low in emotional stability to cope with stress and negative feelings; indeed, a major function of religion

may be to provide comfort and allay existential anxiety (Inzlicht et al., 2011). Conversely, people who are high in emotional stability may be less plagued by stress and worry less in their day-to-day lives than people low in this trait, freeing up time to focus on meaning and higher purpose (Saroglou, 2002). Accordingly, existing studies have yielded conflicting results for associations between emotional stability and religiosity (Aguilar-Vafaie & Moghanloo, 2009; Saroglou, 2002; Saroglou & Muñoz-garcía, 2008; Taylor & MacDonald, 1999).

Overall, there is robust cross-sectional evidence that the Big Five personality traits – particularly agreeableness and conscientiousness – are associated with religiosity. However, cross-sectional evidence provides no information about the temporal dynamics between personality and religiosity.

Development in Personality and Religiosity

Both personality traits and religiosity are malleable constructs that change in predictable ways across the lifespan (Bleidorn et al., 2022; Roberts et al., 2006). Specifically, most people show age-graded increases in traits related to psychological maturity – especially emotional stability, agreeableness, and conscientiousness over the course of the adult lifespan, with the most pronounced changes occurring during young adulthood (Roberts et al., 2006; Roberts & Mrozek, 2008; Schwaba et al., 2022). There is also evidence suggesting that religiosity increases steadily throughout the life course (Bengtson et al., 2015; Bleidorn et al., 2022; McCullough et al., 2005), when taking into account the ongoing trend of secularization over time and generations.

In addition to these normative trends, there is evidence highlighting individual differences in change in both personality (Bleidorn et al., 2009; Mroczek & Spiro, 2003; Roberts et al., 2001; Schwaba & Bleidorn, 2018; Terracciano et al., 2005) and religiosity (Desmond et

al., 2010; Feldman & Newcomb, 1969; Good et al., 2011; King et al., 1997; Koenig et al., 2008; McCullough et al., 2005; Stoppa & Lefkowitz, 2010; Ter Kuile & Ehring, 2014), especially during young adulthood. This research indicated that many people deviate from the normative lifespan trends in personality and religiosity. The substantial variation in personality and religiosity trajectories thus opens the door for investigations into the factors that account for these individual differences in change.

Longitudinal Associations between Personality and Religiosity

Just as people's personality may predispose them to be drawn toward religion, ascribing to a religious lifestyle may trigger the development of certain personality traits toward patterns of thoughts, feelings, and behaviors that align more with religious themes (Entringer et al., 2022; Schnitker et al., 2020; Stronge et al., 2020). These links may be transactional; that is, changes in certain personality traits may evoke intraindividual changes in religiosity, which may, in turn, evoke subsequent changes in personality traits. For example, a person who is high in agreeableness may initially gravitate toward religion to express their prosocial behavior and because many people in their community participate in religious practices. Investing in religious activities and institutions may further reinforce and increase that person's agreeableness (relative to their stable level of agreeableness), which may in turn motivate them to participate even more in religious activities.

Previous longitudinal research provided some evidence for longitudinal links between personality traits and religiosity (e.g., Entringer et al., 2022; Heaven & Ciarrochi, 2007; McCullough et al., 2003). However, a majority of these studies examined whether personality traits predict subsequent changes in religiosity. Consistent with cross-sectional research, these studies found that baseline levels of agreeableness, conscientiousness, and/or openness predicted

individual differences in changes in religiosity when controlling for prior levels of religiosity. Specifically, higher levels of these traits in adolescence or early adulthood relative to others predicted greater relative increases in religiosity over time (Gebauer et al., 2014; McCullough et al., 2005; Streib et al., 2021). Although these studies indicated that personality traits predicted changes in religiosity, they were limited by their number of assessments (e.g., typically 2) and/or the lack of repeated assessments of both personality and religiosity. These limitations restricted the precision of capturing change in religiosity and precluded an examination of reciprocal effects between personality and religiosity.

The very few existing studies that focused on the reciprocal links between personality traits and religiosity over time (Entringer et al., 2022; Huuskes et al., 2013; Wink et al., 2007) have *all* estimated these links using cross-lagged panel models (CLPM; Rogosa, 1980), which are intended to test whether interindividual differences in one construct predict subsequent interindividual change in another (Krauss et al., 2020). Wink et al. (2007) examined the reciprocal effects between agreeableness, conscientiousness, and openness with religiosity in a 2-wave study across a period of nearly 60 years (N = 209). They found that higher levels of agreeableness (in women) and conscientiousness in adolescence predicted higher levels of religiosity in older adulthood (M_{age} = 69 years), controlling for adolescent levels of religiosity. The findings for the reverse effects were more mixed; higher levels of religiosity predicted higher levels of agreeableness in late life in women but not in men. Huuskes et al. (2013) examined the links between the Big Five and religiosity in 410 high school students across 2 annual assessments and found that higher levels of religious values relative to others predicted higher subsequent levels of agreeableness but no effects of agreeableness on subsequent levels of religiosity. Notably, in contrast to cross-sectional findings, they did not find a significant

association between conscientiousness and religiosity. Finally, in a 4-wave study across 12 years, Entringer et al. (2022) found evidence for reciprocal effects between the Big Five and religious service attendance in a sample of over 44,000 German adults. They found that higher levels of agreeableness predicted higher subsequent levels of religiosity relative to others and higher levels of religiosity predicted higher subsequent levels of agreeableness relative to others. Moreover, they found that religiosity predicted decreases in openness, but only in religious contexts. Similar to Huuskes et al. (2013), they found only limited evidence for prospective effects between conscientiousness and religiosity. Specifically, they found an effect of conscientiousness on later increases in religiosity, but this effect was restricted to religious contexts only. Contrary to their hypothesis, however, they did not find evidence for an effect of religiosity on conscientiousness.

In summary, existing findings provided some evidence to support hypotheses regarding longitudinal associations between personality and religiosity, particularly for agreeableness and, to a lesser degree, also for conscientiousness. There is also some evidence to suggest that openness may be associated with changes in religiosity. Again, however, these studies were limited in their personality and religiosity measures and number of measurement occasions. Most importantly, no research to date has examined whether the observed associations between personality and religiosity hold when modeled at the *within*-person level. A major critique of the CLPM used in previous studies is that it confounds stable between-person variance with intraindividual differences (Hamaker et al., 2015; Lucas, 2022). To examine the links between religiosity and personality at the within-person level, multi-wave, short-interval longitudinal designs are needed that control for the stable trait variance in personality and religiosity whilst modeling *intraindividual* associations between religiosity and personality.

Here, we used the random intercept cross-lagged panel model (RI-CLPM; Hamaker et al., 2015) to examine the transactional effects between religiosity and personality while accounting for the stable individual differences in these constructs across time. The RI-CLPM extends the CLPM by including random intercept factors into the model for each variable of interest (e.g., agreeableness and religious service attendance). The random intercept is a latent trait factor estimated from the observed variables that captures stable between-person variance in the variables. The autoregressive and cross-lagged paths are then modeled from the residuals of the observed variables, reflecting temporal associations at the within-person level.

The Present Study

In this study we examined the longitudinal within-person links between the Big Five personality traits and three aspects (belief in God, service attendance, and prayer) of religiosity across 11 annual assessments in a nationally representative sample of Dutch individuals. Using a stepwise approach, we estimated 15 RI-CLPMs to examine the reciprocal effects between personality and religiosity over time.

There were three aims to this study. Our first aim was to replicate the cross-sectional associations between Big Five personality traits and three aspects of religiosity (belief in God, service attendance, prayer). Consistent with theory and existing studies (e.g., Allport, 1950; Saroglou et al., 2010), we expected to find positive cross-sectional correlations between agreeableness and conscientiousness with religiosity at baseline (H1). Specifically, given people's desire to express their personality and the platform religion provides to do so with respect to agreeable behavior (generosity, prosocial behavior, inherent kindness), we predicted that agreeableness would be positively associated with all three aspects of religiosity (H1a). We also predicted that conscientiousness would be positively associated with service attendance and

prayer but not with belief in God (H1b). We further predicted that higher levels of extraversion would be associated with more frequent service attendance (H1c) and predicted emotional stability to be negatively associated with service attendance (H1d) and positively associated with belief in God (H1e). We explored the links between openness and the three aspects of religiosity.

The second aim of the study was to examine the within-person associations between personality and religiosity by estimating RI-CLPMs. In terms of the present study, the cross-lagged paths in the RI-CLPM answer the question "Does an individual's deviation from their average level of religiosity [personality] predict a subsequent deviation from their average level of a personality trait [religiosity]?" We predicted that within-person associations would resemble the between-person associations found between personality and religiosity. Specifically, we expected that higher levels of agreeableness would predict higher levels of each religiosity aspect (H2a) and higher levels of each religiosity aspect would predict higher levels of agreeableness (H2b) at a later time point relative to their usual levels of these variables.

The third aim of our study was to examine the potential effects of three moderators on the stable between-person as well as within-person associations between personality and religiosity over time: age, gender, and religious upbringing. As noted above, the predominant time for change and instability in personality traits and religiosity occurs around young adulthood (Arnett, 2000; Chan et al., 2015; Roberts et al., 2006). This stability increases through middle age, with mixed evidence for the patterns of stability and change of these variables in old age (Cohen-Mansfield et al., 2016; McCullough & Polak, 2007; Wortman et al., 2012). In a study examining how life stage moderates the associations between personality and religiosity, Saroglou (2010) found positive associations between agreeableness and conscientiousness with religiosity across all of the assessed life stages (adolescence, young adulthood, middle

adulthood). However, the association between agreeableness and religiosity was stronger for participants in middle adulthood compared to younger participants. Moreover, extraversion was positively associated with religiosity only in middle adulthood, and openness negatively associated with religiosity only in adolescence. We thus examined age as a moderator in our models by separating people into three age groups: young adulthood (16-35), middle adulthood (36-64), and older adulthood (65+). This allowed us to investigate whether and to what degree stable associations and reciprocal prospective effects between personality and religiosity differ across different stages of life. Differences in the association between personality traits and religiosity across age groups may suggest differences in the intertwinement between identity and religion that may be related to aging or the ongoing secularization trends over time (Bleidorn et al., 2022). Given limited evidence regarding particular patterns of age specificity in religiosity-personality associations, we refrained from making explicit hypotheses and instead explored age differences in the associations.

Gender differences are often prevalent in average levels of personality and religiosity. For example, women report lower levels of emotional stability, and higher levels of agreeableness and religiosity compared to men (Costa et al., 2001; Stark, 2002). Despite these well-established differences, evidence about the role of gender in the association between personality and religiosity has been mixed (Lace et al., 2020). While some research indicated stronger associations between religiosity and personality traits in women (Abdel-Khalek, 2013; Heaven & Ciarrochi, 2007; Lace et al., 2020; Saroglou, 2002; Taylor & MacDonald, 1999; Wink et al., 2007), other research found no gender differences in the links between traits and religiosity (Huuskes, 2013; Saroglou, 2010), or reported stronger personality-religiosity associations in men (Egan et al., 2004; Lace et al., 2020; Maltby & Day, 2001; Taylor & MacDonald, 1999). Given

established evidence on gender differences in personality and religiosity, yet mixed evidence on how gender moderates their associations, we explored this moderation effect across all Big Five traits, particularly expecting the association between agreeableness and religiosity to be stronger in women (H3).

Lastly, some research indicated that the association between religiosity and personality traits may be stronger for people who grew up in religious households (McCullough et al., 2003). This effect may reflect transactional processes: people who grew up in a religious environment likely experienced socialization effects from familial religious obligations. These obligations may have encouraged thoughts, feelings, and behaviors toward religious themes, which in turn could have influenced the degree to which these people selected into religious involvement in later adulthood. For people raised in more secular households, questions and influences of religiosity may have been less pressing and impactful. Investigating this moderator across traits and aspects of religiosity thus provides interesting additional information about transactional effects. Given that little past research has tested this question, we derived no specific hypotheses for moderation by religious upbringing.

Method

Transparency and Openness

We report how we determined our sample size, data exclusions, and all measures in the study. We analyzed data using R, version 4.0.4 (R Core Team, 2021) and the package *lavaan*, version 0.6-8 (Rosseel, 2012). All data, code, and supplementary material are available at https://osf.io/68fxg/?view_only=53b21cc3b868465c8bac2984017140d4. This study used data from the Longitudinal Internet Studies for the Social Sciences (LISS) panel. LISS is a publicly available, de-identified dataset exempt from Institutional Review Board (IRB) approval. Other

research has used this data; an overview is provided at https://www.dataarchive.lissdata.nl/publications. We have used this data previously to investigate religiosity development across the lifespan (Bleidorn et al., 2022). No previous research has used this data to examine the reciprocal relations between personality and religiosity, which is the primary goal of the current study. This study was not pre-registered.[1]

Sample

The LISS panel is a true probability sample of Dutch individuals drawn from the population registrar of the Netherlands (Scherpenzeel et al., 2010). To account for attrition and to maintain the target of 5,000 households, the panel is updated every 2 years by recruiting a refreshment sample, thus maintaining a total sample of ~20,000 participants. Participants completed an array of monthly surveys every year starting in 2007. We used data from all participants who responded to at least one personality assessment and at least one religiosity assessment of the eleven assessment waves from 2008 to 2019.[2] These selection criteria resulted in a total sample of N = 12,940 individuals, ranging from 16 to 100 years of age (54% female, M_{age} = 45.78 years, SD_{age} = 16.20 in 2008; the average participant had the Netherlands equivalent of a high school diploma).

Measures

Personality

At each assessment wave, participants reported on their personality using the 50-item International Personality Item Pool Big Five questionnaire (IPIP; Goldberg, 1992) with 10 items

[1] This study was proposed as a dissertation project and as such the hypotheses and analytic strategy were developed prior to data analyses, albeit not pre-registered.

[2] Within each assessment wave, religiosity was assessed ~4 months prior to personality. Thus, assessments of religiosity are from 2008-2018, whereas assessments of personality are from 2008-2019 with a 'missing' 2016 assessment. This is simply an artifact of religiosity being assessed at the end of 2016, thus personality was not assessed until the beginning of 2017. Despite the difference in year of assessment, the time separation between their assessments is the same and as such, they still fall under the same wave of assessment.

per Big Five domain. Responses were measured on a 5-point Likert scale ranging from 1 (*very inaccurate*) to 5 (*very accurate*). We averaged item responses to obtain a composite trait score for each participant at each assessment wave. At the first assessment, internal consistency ranged from ω_t= .81, α = .77 (conscientiousness) to ω_t = .90, α = .88 (emotional stability).

Religiosity

At each assessment wave, participants responded to a variety of questions pertaining to their religiosity. We used three items from this collection assessed at each wave. The first item "Which of the following statements best matches your idea of God?" was measured on a 6-point Likert scale ranging from 1 (*I do not believe in God*) to 6 (*I believe without any doubt that God exists*). The second item "Aside from special occasions such as weddings and funerals, how often do you attend religious gatherings nowadays?" and third item "Aside from when you attend religious gatherings, how often do you pray?" were measured on a 7-point Likert scale ranging from 1 (*every day*) to 7 (*never*). We reverse coded responses so that 1 indicated *never* and 7 indicated *every day*.

Analyses

For all analyses, we only interpreted effects with a *p*-value < .01 as significant and, accordingly, report 99% confidence intervals. We used Holm's correction (Holm, 1979) to account for multiple testing when calculating the baseline correlations between the Big Five traits and each religiosity aspect. We used a stepwise model-building strategy starting from the baseline CLPM and then added a random intercept to estimate a RI-CLPM (Figure 1). We estimated these models for each combination of religiosity measure and Big Five trait, resulting in 30 models, 15 CLPM + 15 RI-CLPM. We used Full Information Maximum Likelihood to account for missing data. We determined absolute fit using RMSEA and CFI with RMSEA $\leq$ .08

and CFI ≥ .95 indicating good model fit (Cheung & Rensvold, 2002) and used χ^2 difference tests for all nested model comparisons, with $p < .01$ indicating a significant difference in model fit. For both the CLPM and RI-CLPM, we estimated all paths using the observed variables for the Big Five traits and religiosity. We first constrained all auto-regressive paths and all cross-lagged paths to be equal. We next examined if freeing these paths significantly improved model fit using χ^2 tests. Lastly, since this stepwise design is a nested model structure (CLPMs nested within RI-CLPMs), we used χ^2 tests upon each step to compare whether each subsequent model fit significantly better to the data compared to the preceding, more parsimonious model. For the purposes of this study, we focus on the RI-CLPM. For meta-scientific purposes, we report all information regarding CLPMs in the supplementary materials (see Tables S1-S3).

Aim 1: Replicate prior research

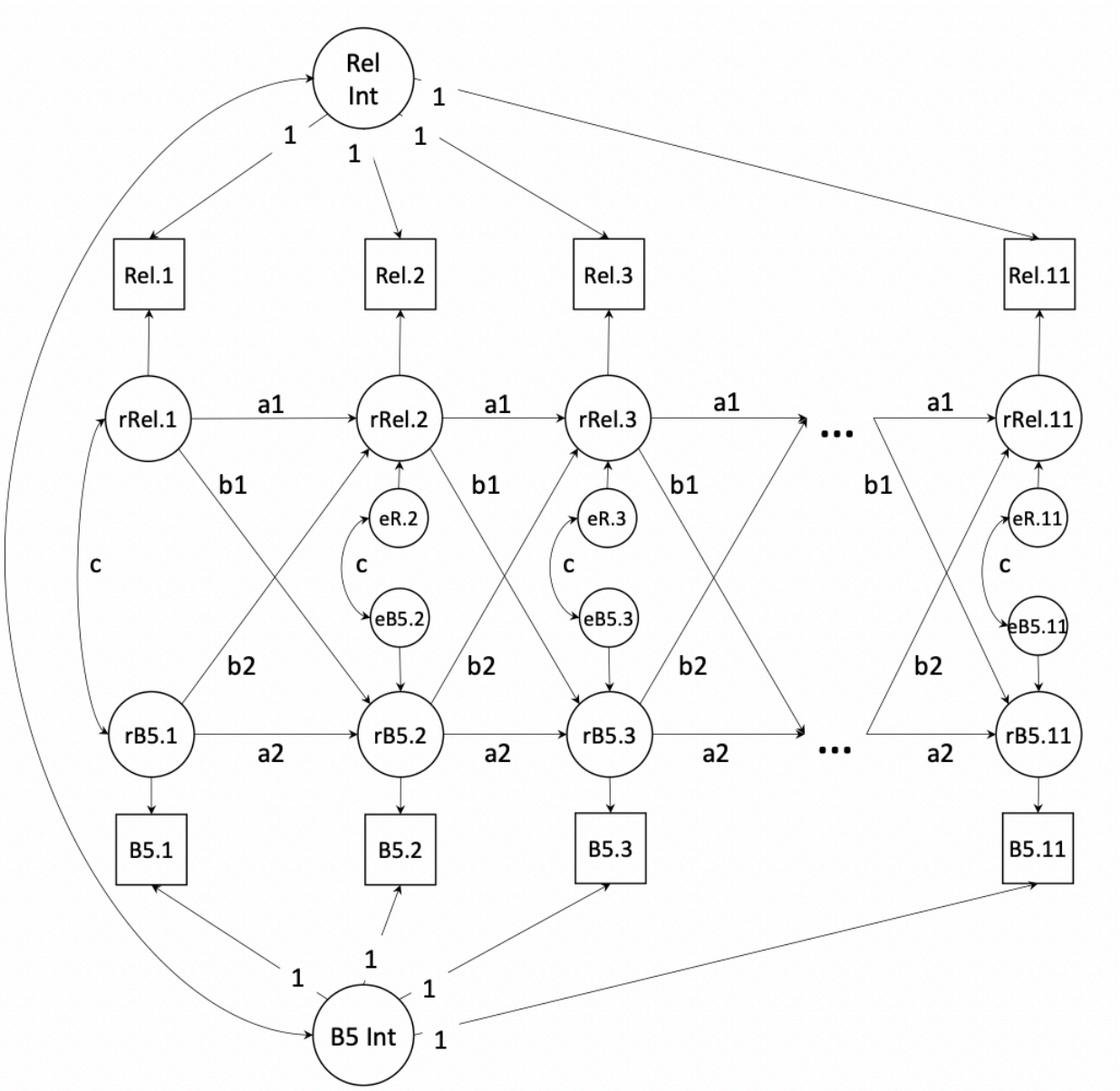
To replicate the cross-sectional associations between the Big Five traits and religiosity observed in previous research (H1), we first calculated the correlations between each Big Five trait and each religiosity aspect at participants' baseline assessment.

Aim 2: Intraindividual associations

To examine the intraindividual associations between personality and religiosity, we next estimated RI-CLPMs for each Big Five trait and religiosity aspect. This allowed us to investigate both between-person effects and the within-person reciprocal effects over time. The intercepts in the RI-CLPM represent the baseline stable interindividual differences in each variable. Thus, the correlated intercepts in the RI-CLPM represent associations between baseline levels of a select personality trait and religiosity aspect, relative to others. The cross-lags in the RI-CLPM indicate whether a deviation from an individual's average levels of religiosity predicts a subsequent deviation in their average levels of a personality trait, and vice versa. We expected between-

Figure 1

RI-CLPM Path Diagram



Note. Path diagram of the RI-CLPM for a religiosity aspect (i.e., Rel) and Big Five trait (i.e., B5) across 11 waves. Squares indicate observed variables, circles indicate latent intercepts (Int), residuals (r), and error (e). Within-person autoregressions (a1; a2), cross-lags (b1; b2), and correlations (c), constrained to equality across waves, respective to each variable (i.e., religiosity aspect and Big Five trait).

person associations between agreeableness and religiosity to translate to the within-person level (H2). In addition to testing within-person cross-lagged effects, which were the main focus of our analyses, we also estimated within-person wave-specific associations between personality traits and religiosity. These analyses allowed us to examine whether participants' deviations from their average personality trait score in a wave were associated with deviations from their average religiosity score in that same wave.

Aim 3: Moderators of associations

We examined whether age, gender, and religious upbringing had a moderating effect on the association between personality traits and religiosity. In the RI-CLPMs, we used χ^2 model comparison tests in a multiple group model framework to examine whether groups significantly differed in their random intercept correlations and/or cross-lags. Specifically, we tested whether sequentially freeing the equality constraints on intercept correlations and cross-lags across groups resulted in a significant change in model fit. A significant difference in model fit would suggest the groups differed in their intercept correlations and/or cross-lags.

Results

Descriptives

Sample sizes, means, and standard deviations for each measured variable from 2008-2019 are listed in Table 1.

Table 1

Sample sizes, means, and standard deviations for Big Five and religiosity variables across assessment years

	Personality						Religiosity					
		Extraversion	Agreeableness	Conscientiousness	Emotional Stability	Openness	Belief in God		Service Attendance		Prayer	
	N	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*N*	*M* (*SD*)	*N*	*M* (*SD*)	*N*	*M* (*SD*)
2008	6686	3.30 (0.63)	3.90 (0.49)	3.72 (0.52)	3.41 (0.68)	3.51 (0.50)	6716	3.47 (1.82)	6701	2.08 (1.48)	6683	2.88 (2.40)
2009	5587	3.28 (0.63)	3.88 (0.49)	3.69 (0.53)	3.42 (0.66)	3.49 (0.49)	5714	3.46 (1.83)	5690	2.12 (1.51)	5664	2.97 (2.43)
2010	1318	3.28 (0.63)	3.88 (0.49)	3.68 (0.55)	3.38 (0.66)	3.47 (0.49)	6081	3.40 (1.84)	6041	2.08 (1.52)	6017	2.93 (2.43)
2011	5270	3.25 (0.63)	3.85 (0.49)	3.69 (0.53)	3.46 (0.67)	3.46 (0.49)	5604	3.37 (1.83)	5547	2.07 (1.52)	5535	2.92 (2.43)
2012	1430	3.31 (0.66)	3.87 (0.48)	3.66 (0.55)	3.41 (0.68)	3.49 (0.50)	6028	3.28 (1.83)	5979	2.01 (1.49)	5952	2.81 (2.40)
2013	5121	3.24 (0.65)	3.85 (0.51)	3.71 (0.53)	3.49 (0.69)	3.45 (0.50)	5857	3.18 (1.83)	5805	2.00 (1.49)	5788	2.76 (2.38)
2014	6311	3.24 (0.66)	3.88 (0.51)	3.73 (0.53)	3.46 (0.70)	3.48 (0.50)	5937	3.15 (1.82)	5882	1.96 (1.46)	5870	2.71 (2.36)
2015	488	3.27 (0.65)	3.85 (0.55)	3.53 (0.58)	3.36 (0.73)	3.58 (0.52)	6057	3.14 (1.83)	6029	1.97 (1.46)	6014	2.69 (2.35)
2016/7	5896	3.24 (0.67)	3.88 (0.52)	3.74 (0.53)	3.46 (0.70)	3.51 (0.51)	5557	3.10 (1.83)	5507	1.93 (1.44)	5495	2.64 (2.32)
2017/8	772	3.23 (0.68)	3.84 (0.54)	3.64 (0.54)	3.35 (0.71)	3.55 (0.53)	6150	3.08 (1.84)	6098	1.94 (1.45)	6092	2.63 (2.34)
2018/9	4950	3.20 (0.66)	3.84 (0.52)	3.73 (0.52)	3.48 (0.71)	3.48 (0.50)	5527	3.06 (1.83)	5482	1.90 (1.41)	5476	2.59 (2.30)

Note. The final 3 assessment occurred in different years for personality and religiosity, with religiosity preceding personality (e.g., 2016 religiosity and 2017 personality).

Replication of cross-sectional associations between personality and religiosity

Table 2 shows the correlations between the Big Five personality traits and each of the three religiosity aspects at baseline. The absolute magnitude of effect sizes was small, ranging from r = -.03 (emotional stability with prayer) to r = .12 (agreeableness with belief in God). Agreeableness had the strongest associations with religiosity relative to the other Big Five traits. With regard to religiosity, we found the fewest number of and smallest effect sizes for associations between service attendance and personality traits.

Table 2

Baseline correlations between Big Five personality traits and religiosity

	Belief in God			Service Attendance			Prayer		
	r	*p*	99% CI	*r*	*p*	99% CI	*r*	*p*	99% CI
Emotional Stability	**-.043**	< .001	-.074, -.011	-.005	.653	-.030, .021	**-.034**	.004	-.065, -.003
Extraversion	-.014	.342	-.042, .014	-.021	.129	-.050, .009	-.022	.129	-.052, .009
Openness	**-.085**	< .001	-.119, -.051	**-.073**	< .001	-.106, -.039	**-.054**	< .001	-.087, -.022
Agreeableness	**.120**	< .001	.086, .154	**.060**	< .001	.027, .093	**.107**	< .001	.073, .141
Conscientiousness	**.082**	< .001	.049, .116	**.049**	< .001	.017, .081	**.083**	< .001	.050, .117

Note. Holm's correction was used to account for multiple testing. Bolded values indicate $p < .01$.

Intraindividual associations

Fit statistics for all CLPMs, RI-CLPMs, and their model comparison tests are presented in Table S1 of the supplementary material. Overall, all RI-CLPMs had excellent fit with CFI > .95 and RMSEA < .08. Model comparison tests between the CLPM and RI-CLPM indicated that the RI-CLPM consistently fit the data better than the CLPM (e.g., for emotional stability $\Delta\chi^2/\Delta df = 13884/3$, $\Delta CFI = .128$, $\Delta RMSEA = .051$, $p < .001$). The standardized within-person autoregressive estimates are listed in Table 3. The standardized within-person cross-lagged estimates as well as random intercept correlations from the RI-CLPMs are shown in Table 4.

Paths did not vary in magnitude across time, and thus only one estimate per each variable (e.g., personality predicting religiosity and vice versa) is listed in the table for each model. This reflects our theory that associations would be consistent across measurement waves and also aggregates our power across cross-lagged paths in order to estimate associations with greater precision.

The within-person autoregressions were moderate in effect size and significant across all Big Five traits and religiosity aspects. This illustrated that, for example, individuals who reported being less emotionally stable than their average levels of emotional stability subsequently reported being less emotionally stable again in the following year. These autoregressive effects were, on average, largest for emotional stability and smallest for belief in God.

A comparison between the intercept correlations and cross-lagged effects in the RI-CLPMs highlights that the significant associations between personality and religiosity predominately occurred at the between-person level, as illustrated in Table 4. For these stable between-person associations, the absolute magnitude of effect sizes was small, ranging from -.026 (extraversion with service attendance) to .131 (agreeableness with belief in God). Again, we found the strongest effects for agreeableness relative to the other Big Five traits and the weakest effects for service attendance relative to the other religiosity aspects.

Table 3

Within-person autoregressions for Big Five and religiosity variables across assessment years

	Personality										Religiosity					
	Extraversion		Agreeableness		Conscientiousness		Emotional Stability		Openness		Belief in God		Service Attendance		Prayer	
	Est.	99% CI	Est.	99% CI	Est.	99% CI	Est.	99% CI	Est.	99% CI	Est.	99% CI	Est.	99% CI	Est.	99% CI
2008 → 2009	.360	.333, .387	.297	.269, .325	.333	.306, .361	.383	.357, .408	.280	.251, .309	.176	.160, .191	.233	.217, .249	.308	.291, .325
2009 → 2010	.364	.328, .400	.287	.254, .322	.314	.281, .349	.365	.332, .399	.259	.226, .292	.174	.158, .190	.245	.227, .262	.319	.301, .338
2010 → 2011	.352	.313, .390	.310	.273, .349	.348	.309, .387	.418	.377, .459	.277	.240, .313	.172	.156, .188	.230	.213, .246	.305	.287, .324
2011 → 2012	.326	.294, .359	.253	.224, .283	.280	.250, .310	.359	.327, .392	.227	.199, .255	.175	.159, .191	.242	.225, .260	.318	.298, .337
2012 → 2013	.343	.308, .378	.318	.281, .355	.328	.293, .364	.386	.349, .423	.287	.251, .323	.169	.152, .185	.239	.221, .256	.289	.270, .307
2013 → 2014	.338	.308, .369	.276	.247, .307	.307	.277, .337	.369	.339, .399	.245	.217, .274	.173	.156, .189	.252	.233, .271	.303	.284, .323
2014 → 2015	.315	.265, .366	.247	.206, .289	.261	.220, .303	.307	.262, .352	.243	.201, .286	.155	.140, .170	.226	.208, .244	.284	.265, .303
2015 → 2016	.372	.317, .427	.330	.279, .384	.364	.312, .418	.459	.395, .522	.287	.239, .334	.175	.157, .192	.208	.192, .225	.279	.260, .298
2016 → 2017	.286	.237, .335	.262	.214, .312	.268	.220, .316	.320	.266, .374	.217	.176, .258	.166	.150, .183	.242	.223, .262	.302	.281, .323
2017 → 2018	.397	.329, .464	.304	.249, .360	.358	.298, .420	.430	.360, .500	.302	.246, .360	.164	.147, .181	.242	.222, .263	.302	.280, .324

Note. All autoregressions were significant at $p < .001$.

With regard to the intraindividual associations between personality and religiosity, we found significant effects for only two of the five personality traits and only one of the three religiosity aspects. Specifically, both agreeableness and extraversion were weakly associated with belief in God at the within-person level. For agreeableness, we found positive reciprocal within-person associations with belief in God, indicating that individuals who reported higher levels of agreeableness relative to their average levels of agreeableness subsequently reported higher levels of belief in God relative to their average levels of belief in God, and vice versa. For extraversion, we found a positive prospective within-person effect on belief in God, indicating that individuals who reported being more extraverted than their average levels of extraversion subsequently reported believing in God more strongly compared to their average levels of belief.

We also explored the within-person wave-specific correlations between personality traits and religiosity. These associations indicated whether participants' deviations from their average personality trait score in one year were associated with deviations from their average religiosity score in that same year. Notably, because personality and religiosity were assessed in separate surveys, measurements within the same wave were nonetheless on average 4 months apart from one another, rather than concurrent (see limitations section for further details). None of the 15 within-person wave-specific associations (5 Big Five traits × 3 religiosity aspects) were significant at $p < .01$.

Table 4

Random Intercept Cross-Lagged Panel Model Results

	Belief in God			Service Attendance			Prayer		
	Est.	*p*	99% CI	Est.	*p*	99% CI	Est.	*p*	99% CI
Emotional Stability									
Intercept Correlation	**-.053**	< .001	-.080, -.027	.006	.561	-.020, .032	-.023	.025	-.049, .003
Religiosity → Trait	-.006	.368	-.024, .011	-.004	.555	-.022, .014	-.002	.772	-.021, .017
Trait → Religiosity	-.016	.020	-.033, .002	.003	.669	-.014, .020	-.012	.065	-.028, .005
Extraversion									
Intercept Correlation	**-.037**	< .001	-.063, -.011	**-.026**	.008	-.052, -.001	**-.040**	< .001	-.065, -.014
Religiosity → Trait	.007	.328	-.011, .025	-.004	.564	-.022, .014	-.004	.568	-.023, .015
Trait → Religiosity	**.018**	.009	.000, .036	-.011	.105	-.029, .006	.002	.713	-.015, .019
Openness									
Intercept Correlation	**-.121**	< .001	-.147, -.096	**-.079**	< .001	-.105, -.053	**-.081**	< .001	-.106, -.055
Religiosity → Trait	.001	.909	-.018, .020	.001	.858	-.017, .020	.014	.078	-.006, .034
Trait → Religiosity	.009	.189	-.009, .027	-.009	.179	-.026, .008	.001	.845	-.016, .018
Agreeableness									
Intercept Correlation	**.131**	< .001	.105, .158	**.072**	< .001	.046, .099	**.114**	< .001	.088, .140
Religiosity → Trait	**.021**	.003	.003, .040	.008	.277	-.011, .026	.010	.198	-.010, .030
Trait → Religiosity	**.027**	< .001	.010, .045	-.002	.809	-.019, .016	.013	.038	-.003, .030
Conscientiousness									
Intercept Correlation	**.085**	< .001	.058, .111	**.057**	< .001	.031, .083	**.093**	< .001	.067, .119
Religiosity → Trait	.004	.525	-.014, .023	-.003	.671	-.021, .015	-.012	.101	-.032, .007
Trait → Religiosity	.010	.160	-.008, .028	.004	.532	-.013, .022	.001	.860	-.016, .018

Note. Bolded values indicate $p < .01$.

Moderators of associations

To address the third study aim, we examined the moderating effects of age, gender, and religious upbringing on both the intercept correlations and the cross-lagged effects in the RI-CLPM. Constraining intercept correlations and cross-lags to be equal across age groups did not produce significantly worse fitting models compared to the free models, suggesting no age differences in the associations between personality traits and religiosity.

Constraining intercept correlations to be equal across men and women produced significantly worse fitting models for extraversion, agreeableness, and conscientiousness, as shown in Table 5. For extraversion, we found significant negative intercept correlations with all three religiosity aspects in women and no significant correlations in men. Additionally, this model also fit worse when constraining cross-lags to be equal across gender. However, no cross-lags met our alpha level for significance (e.g., for women, deviations in extraversion negatively predicted subsequent service attendance with r = -.022, but p = .016). For agreeableness, we found significant positive intercept correlations with all three religiosity aspects in men and no significant links in women. Finally, we found a stronger positive correlation between conscientiousness and belief in God in men than in women.

Table 5

RI-CLPM Intercept correlations by gender

	Belief in God			**Service Attendance**			**Prayer**		
	r	*p*	99% CI	*r*	*p*	99% CI	*r*	*p*	99% CI
Extraversion									
Men	-.002	.873	-.040, .036	-.007	.640	-.044, .031	-.011	.460	-.048, .027
Women	**-.071**	< .001	-.105, -.036	**-.043**	.001	-.078, -.009	**-.066**	< .001	-.101, -.032
Agreeableness									

Men	**.159**	< .001	.121, .198	**.124**	< .001	.085, .163	**.150**	< .001	.111, .188
Women	.031	.032	-.006, .068	.005	.711	-.031, .042	.028	.046	-.008, .065
Conscientiousness									
Men	**.114**	< .001	.076, .153	-	-	-	-	-	-
Women	**.040**	.004	.004, .076	-	-	-	-	-	-

Note. Estimates for conscientiousness with service attendance and prayer are not listed as models did not fit significantly worse when men and women were constrained to be equal across parameters. Bolded values indicate $p < .01$.

Lastly, we also found an effect of participants' religious upbringing on the links between openness and religiosity. Specifically, the negative correlations between openness and all three religiosity aspects were significantly more pronounced among participants who grew up in a religious family compared to those who grew up in a non-religious family. Compared to participants who grew up in a non-religious family, participants who grew up in a religious family had a stronger negative association between openness and belief in God (r = -.138, p < .001; r = -.044, p = .009), service attendance (r = -.082, p < .001; r = .009, p = .590), and prayer (r = -.093, p = < .001; r = .016, p = .339).

Discussion

The present study is the first to examine the reciprocal links between personality and religiosity at the within-person level, using 11-wave longitudinal data collected in a nationally representative sample of over 12,000 Dutch adults. Consistent with previous studies, we found the strongest links between agreeableness and religiosity. We further found that associations between personality and religiosity predominately occurred at the between-person level, indicating stable associations between personality dispositions and religious involvement.

Replication of cross-sectional associations between personality and religiosity

Cross-sectional associations between personality traits and religiosity largely replicated what has been found in prior research. Four findings stand out. First, we found support for our first hypothesis (H1) regarding positive associations between the religiosity aspects and agreeableness and conscientiousness (Ashton & Lee, 2021), albeit they were small in magnitude. As predicted, we found positive associations between agreeableness and all three religiosity aspects (H1a). We also found positive associations between conscientiousness and the two behavioral manifestations of religiosity, service attendance and prayer, as predicted (H1b). In contrast to our prediction, this trait was also positively correlated with belief in God, a cognitive manifestation of religiosity. Overall, the observed associations support the hypothesis that people who are more agreeable and conscientious than others may be more drawn to religious ideas and practices because these provide an ideal platform to express those traits (Allport, 1950). The small magnitude of these associations may be partly explained by the secular context of this study. The Netherlands is among the most secular countries in the world with decreasing rates of religious involvement across the population (Bleidorn et al., 2022; Pew Research Center, 2015). Existing research has found a similar pattern of decreasing religiosity links with agreeableness and conscientiousness as sociocultural religiosity decreases (Entringer et al., 2021; Gebauer et al., 2014).

Second, unlike some previous studies, we found negative associations between openness and all aspects of religiosity, indicating that people who were more open than others tended to be less religious (Ashton & Lee, 2019; Gebauer et al., 2014). This finding is inconsistent with prior research suggesting that the association between openness and religiosity becomes more positive with decreasing sociocultural religiosity (but see, Furnham & Cheng, 2015). This negative association may be partly explained by differences in the measures used to assess openness in

this and previous studies. Previous studies measured openness with instruments that focused strongly on open-mindedness and curiosity (Gebauer et al., 2014). In the present study, we used a measure that was more tuned towards the intellect aspects of openness (Schwaba et al., 2018). Several previous studies and meta-analytic research found that intellect and education tend to be negatively associated with religiosity (Bleidorn et al., 2022; Dürlinger & Pietschnig, 2022; Schwadel, 2015; Zuckerman et al., 2013). The intellect-related content of the openness measure used in this study may thus partly explain the negative links with religiosity observed here. Another reason for the negative association between openness and religiosity may be differences in the aspects of religiosity used in the present study. The three variables used here focused mostly on traditional behavioral and cognitive aspects of religiosity. However, several studies indicated that openness tends to be positively linked to spiritual aspects of religiosity but negatively associated with more fundamentalist aspects of religiosity (Ashton & Lee, 2019, 2021; Saroglou, 2002, 2010; Saucier & Skrzypińska, 2006).

Third, we found no significant correlations between extraversion and the religiosity variables, contrary to our prediction (H1c). This finding supports prior research that has found no association between extraversion and traditional religiosity (Saroglou, 2010), at least in secular countries like the Netherlands (Gebauer et al., 2014). Nonetheless, null associations between religious service attendance and extraversion were somewhat surprising, given the former's status as an outgoing, sociable behavior. This finding underscores the value of disaggregating religiosity into constituent components to better understand processes linking it to personality.

Fourth, unlike previous studies and contrary to our predictions, we found negative associations between emotional stability and two religiosity aspects: belief in God and prayer. This indicated that people who were less emotionally stable than others also tended to believe in

God more strongly and/or engage in prayer more often than others. We expected to find differential associations between emotional stability and religiosity dependent on the degree to which each religiosity aspect reflected extrinsic (i.e., service attendance) versus intrinsic (i.e., belief in God) religiosity (H1d; H1e), as prior research found emotional stability to be negatively associated with extrinsic religiosity and positively associated with intrinsic religiosity (Saroglou, 2002). The observed negative association between emotional stability and religiosity may reflect a person-culture mismatch effect (Fulmer et al., 2010). Specifically, prior research found that the association between psychological adjustment and religiosity is contingent on the sociocultural religiosity of the nation, such that religious people have higher self-esteem only to the extent they reside in a religious society (Gebauer et al., 2017; Stavrova et al., 2013). There may be a mismatch between religious individuals residing in the Netherlands, who may thus not gain adjustment benefits from practicing religion. Consequently, people higher in religiosity may be less emotionally stable compared to their less religious counterparts.

Overall, our analyses largely replicated prior evidence at the between-person level, particularly for agreeableness and conscientiousness, with one exception. The negative links between openness and religiosity were not consistent with evidence and theory noting this association as culturally dependent. As discussed above, this could be due to differences in both trait and religious expressions captured by our study.

Longitudinal links between personality and religiosity

The second goal of this study was to investigate whether the between-person links found between personality and religiosity translate to the within-person level using RI-CLPM. We first examined the between-person intercept correlations between the Big Five traits and religiosity and then examined their intraindividual associations over time.

Between-person associations

With regard to the stable interindividual correlations between the Big Five traits and religiosity, two findings stand out. First, results mostly mimicked prior research and our cross-sectional findings. That is, agreeableness and conscientiousness were positively associated with religiosity, and emotional stability and openness were negatively associated with religiosity. This indicated that people who were more agreeable and/or conscientious than others were also more religious than others. Moreover, people who were more emotionally stable and/or open than others were also less religious than others.

Second, unlike prior cross-sectional and longitudinal research (Ashton & Lee, 2021) and our cross-sectional findings, we found negative associations between extraversion and all three religiosity aspects. That is, people who were more extraverted than others across the 11-year study period were also less religious across all assessment waves. These negative links between extraversion and religiosity may be linked to differential associations with different expressions of religiosity (i.e., traditional vs. spiritual). Traditional religiosity may be interpreted as more of a professional obligation (e.g., school, work) than an enjoyable social community. Thus, people who are more extraverted than others may have less desire to engage in religious practices in preference for a less-structured social event that has more behavioral freedom to socialize. Alternatively, it is possible that people who are less extraverted than others still have a desire to find community, albeit in a more structured environment and thus seek out religious services.

Within-person associations

A majority of the between-person associations did not emerge at the within-person level, demonstrating the importance of accounting for stable trait-like variance in the RI-CLPM when interpreting cross-lagged effects between two variables. We found no significant within-person

wave-specific correlations between personality and religiosity. This indicated that, for example, in years where participants were more agreeable, they did not believe more strongly in God. Rather, only prospective effects of one wave on the next were significant within-person, suggesting a process with greater time-lagged effects. Of the 30 tested cross-lagged associations, we found significant cross-lagged effects only in 3 cases, restricted to the traits of agreeableness and extraversion and the religious aspect belief in God.

Contrary to our predictions (H2), we did not find reciprocal associations between agreeableness and all aspects of religiosity at the within-person level. Rather, we only found reciprocal associations between agreeableness and one aspect of religiosity: belief in God. Specifically, individuals who were more agreeable compared to their usual levels of agreeableness tended to believe more strongly in God at the next measurement occasion. Likewise, individuals who increased in their belief in God compared to their average levels of belief in God tended to be more agreeable at the next measurement occasion, compared to their average levels of agreeableness. This reciprocal effect might reflect transactional effects between agreeableness and religiosity. For example, a shift in agreeableness may lead a person to strengthen their belief in a higher being who preaches compassion and prosocial behavior, thus allowing this person to express their agreeableness, and the practices encouraged by the religious deity reflect and, in turn, may further reinforce traits subsumed by agreeableness, e.g., prosociality, sympathy, generosity (Wrzus & Roberts, 2017). Put simply, this agreeable person started to believe more strongly in God, and the agreeableness-promoting nature of religion served to increase their baseline agreeableness.

Additionally, we found a positive effect of extraversion on belief in God at the within-person level, indicating that individuals who were more extraverted compared to their average

levels of extraversion subsequently believed more strongly in God, relative to their average levels of belief. Notably, this finding contrasts with the between-person associations of both the null baseline correlations and the negative intercept correlations between extraversion and all religiosity aspects. Taken together, these findings may highlight an important distinction in between- vs. within-person effects. On average, we found that people who were more extraverted than others tended to engage less in religious practices compared to their introverted counterparts. At the same time, individuals who were more extraverted compared to their usual levels of extraversion (regardless of how their extraversion compared to others), appeared to increase in their belief in God compared to their average levels of belief. Notably, given that we did not predict this finding, we refrain from strong conclusions before it is replicated in future research.

A general comparison of the effects found in the between- and within-person analyses leads to two broader conclusions about research on religiosity and personality. First, the association between personality traits and religiosity was not consistent across all three religiosity variables. That is, we found more significant and more pronounced effects for belief in God compared to the other religiosity variables. Moreover, we found the weakest associations for service attendance with the personality traits, which is notable given the common usage of service attendance as the sole indicator of religiosity in prior research (Gebauer et al., 2014; Schwartz & Huismans, 1995). This finding highlights the value of using a multi-faceted approach when assessing people's religiosity (Chan et al., 2015).[3]

[3] Baseline correlations between the three religiosity aspects can be found in Table S4 of the supplementary material. Correlations ranged from $r = .59$ to $r = .71$, suggesting strong associations but, importantly, little to no conceptual redundancy between the religiosity aspects.

Second, and most important for the present study, the associations between personality traits and religiosity occurred primarily at the between-person (as opposed to within-person) level, as indicated by a comparison of the intercept correlations and cross-lagged effects in the RI-CLPMs. This finding emphasizes the importance of distinguishing between-person from within-person effects to gain a better understanding of the developmental associations between variables. Between-person differences are often theorized to be the result of aggregated within-person processes (Wrzus & Roberts, 2017), but the two are sometimes discrepant, as we found in this study. These discrepancies also provide additional insights into the causal link between personality and religiosity. For example, the significant corresponsive associations between agreeableness and religiosity position each as plausible causal factors in the development of the other; on the other hand, nonsignificant within-person associations of openness and conscientiousness with religiosity suggest that the between-person links we found may emerge through a more complex or perhaps noncausal set of processes (e.g., Osborne & Sibley, 2020).

Moderators

The third aim of our study was to examine the moderating effects of age, gender, and religious background on associations between personality traits and religiosity. We did not find a significant moderating effect of life stage on any of the between- or within-person effects in the RI-CLPMs. This finding suggests a stable association between personality traits and religiosity across the lifespan. That is, despite age differences in both personality and religiosity, their association with one another persists above and beyond people's life stage. However, a moderating effect may be more nuanced in a way that is not detectable when clustering age into three separate groups. Further research examining age as a continuous moderator may uncover differences in these associations across age.

We found that gender moderated the association between personality and religiosity at the between-person level for extraversion, agreeableness, and conscientiousness. Specifically, we found significant negative associations between levels of extraversion and each of the three religiosity aspects in women but not in men. In contrast, we found significant positive associations between levels of agreeableness and each religiosity aspect in men but not in women, in contrast to our predictions (H3). This finding is noteworthy given established evidence that women tend to be more agreeable and religious than men (Costa et al., 2001; Stark, 2002). One explanation for this finding may be that women tend to be high in agreeableness regardless of their levels of religiosity, whereas individual differences in men's levels of agreeableness is not independent from their individual differences in religiosity. Lastly, men had a stronger positive association between conscientiousness and belief in God than women. This indicated that people who were more conscientious than others also believed in God more strongly than others, but the intensity of this effect was more pronounced in men than in women. These differences may be attributed to established gender differences in religiosity and illustrates the importance of investigating associations between personality and religiosity across different groups.

Finally, religious upbringing significantly moderated the association between openness and all three religiosity aspects at the between-person level. Specifically, people who grew up in a religious family had a stronger negative association between levels of openness and belief in God, service attendance, and prayer. This indicated that people who were more open than others were also less religious than others, and the intensity of this effect was more pronounced in people who grew up in a religious family versus those who did not. Indeed, prior research has shown that people who grew up in religious families yet became non-religious in adulthood have

high levels of openness (Ashton & Lee, 2019). This negative association between openness and religious upbringing has been connected to the finding that the motivating force behind students becoming nonreligious after being raised religious was an intellectual skepticism about their family religion (Altemerye & Hunsberger, 1997). This finding may further point to transactional effects that occur perhaps earlier in life, leading to stable between-person differences in the absence of significant within-person effects.

Limitations

The present study had several strengths that allowed us to replicate and extend on prior research, thus further exploring the nature of the associations between personality and religiosity. Nonetheless, there were also limitations. First, there was a ~4-month separation between assessments of personality and religiosity at each wave, with religiosity preceding personality. This is inconsistent with typical RI-CLPM designs in which assessments are made concurrently, and the space between the following assessment is the same for each variable. Second, we planned to estimate local structural equation models (LSEM; Hildebrandt et al., 2016) with age as a continuous moderator, but these models did not converge and thus we were restricted to moderator analyses using age groups.[4] Third, our data came from participants residing in the Netherlands which is a particularly secular nation and religious variables were skewed in favor of low religiosity, thus restricting the generalizability of our findings.

Conclusion

We investigated between- and within-person reciprocal effects between the Big Five personality traits and three aspects of religiosity: belief in God, service attendance, and prayer.

[4] LSEM requires sufficient sample size for each level of the moderator variable as well as values for the moderator variable for each model estimation, thus working best with full or missing at random data. Though we had a sufficient sample size for each level of age, the pattern of survey distribution in the LISS created instances of missingness that were not completely random and, as such, the models failed to converge.

Cross-sectional and longitudinal between-person analyses mostly replicated prior research with positive associations between agreeableness and conscientiousness with religiosity. In contrast, we found few intraindividual associations between personality and religiosity, with only extraversion and agreeableness being positively associated with belief in God at the within-person level. Gender moderated the associations between extraversion, agreeableness, and conscientiousness with religiosity; religious upbringing moderated the association between openness and religiosity. These findings reinforce some major findings regarding personality and religiosity and refine our understanding of the temporal dynamics that may give rise to associations.

References

Abdel-Khalek, A. M. (2013). Personality dimensions and religiosity among Kuwaiti Muslim college students. *Personality and Individual Differences*, *54*(2), 149-152.

Aghababaei, N. (2014). God, the good life, and HEXACO: The relations among religion, subjective well-being and personality. *Mental Health, Religion & Culture, 17*(3), 284-290. doi:http://dx.doi.org/10.1080/13674676.2013.797956

Aguilar-Vafaie, M., & Moghanloo, M. (2008). Domain and facet personality correlates of religiosity among Iranian college students. *Mental Health, Religion and Culture*, *11*(5), 461–483. https://doi.org/10.1080/13674670701539114

Allport, G. W. (1950). *The individual and his religion.* New York, NY: Wiley.

Allport, G. W., & Odbert, H. S. (1936). Trait names: A psycho-lexical study. *Psychological Monographs, 47,* (*1,* Whole No. 211).

Altemeyer, B., & Hunsberger, B. (1997). *Amazing conversions: Why some turn to faith and others abandon religion.* New York, NY: Prometheus Books.

Arnett, J. J. (2000). A theory of development from the late teens through the twenties. *American Psychologist, 55*(5), 469–480. doi:10.1037//0003-066X.55.5.469.

Ashton, M. C., & Lee, K. (2019). Religiousness and the HEXACO personality factors and facets in a large online sample. *Journal of Personality*, *87*(6), 1103–1118. https://doi.org/10.1111/jopy.12459

Ashton, M. C., & Lee, K. (2021). A review of personality/religiousness associations. *Current Opinion in Psychology*, *40*, 51-55.

Bengtson, V. L., Silverstein, M., Putney, N. M., & Harris, S. C. (2015). Does religiousness increase with age? Age changes and generational differences over 35 years. *Journal for the Scientific Study of Religion, 54,* 363-379.

Bleidorn, W., Kandler, C., Riemann, R., Spinath, F. M., & Angleitner, A. (2009). Patterns and sources of adult personality development: growth curve analyses of the NEO PI-R scales in a longitudinal twin study. *Journal of personality and social psychology*, *97*(1), 142–155. https://doi.org/10.1037/a0015434

Cerasa, A., Lombardo, G., Tripodi, D., Stilisano, E., Sarica, A., Gramigna, V., . . . & Zucaro, D. L. (2016). Five-factor personality traits in priests. *Personality and Individual Differences, 95*, 89-94. doi:http://dx.doi.org/10.1016/j.paid.2016.02.040

Chan, M., Tsai, K. M., & Fuligni, A. J. (2015). Changes in Religiosity Across the Transition to Young Adulthood. *Journal of Youth and Adolescence*, *44*, 1555–1566.

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling*, *9*(2), 233–255. https://doi.org/10.1207/S15328007SEM0902_5

Cohen-Mansfield, J., Shmotkin, D., & Hazan, H. (2016). Changes in religiosity in old age: An exploratory study. *The International Journal of Aging and Human Development*, *83*(3), 256-273.

Costa Jr, P. T., Terracciano, A., & McCrae, R. R. (2001). Gender differences in personality traits across cultures: robust and surprising findings. *Journal of personality and social psychology*, *81*(2), 322.

Desmond, S. A., Morgan, K. H., & Kikuchi, G. (2010). Religious Development: How (and Why) Does Religiosity Change from Adolescence to Young Adulthood? *Sociological Perspectives*, *53*(2), 247–270. https://doi.org/10.1525/sop.2010.53.2.247

Dürlinger F., & Pietschnig, J., (2022) Meta-analyzing intelligence and religiosity associations: Evidence from the multiverse. *PLoS ONE 17*(2): e0262699. https://doi.org/10.1371/journal.pone.0262699

Eck, J., & Gebauer, J. E. (2021). A sociocultural norm perspective on Big Five prediction. *Journal of personality and social psychology*.

Egan, E., Kroll, J., Carey, K., Johnson, M., & Erickson, P. (2004). Eysenck personality scales and religiosity in a US outpatient sample. *Personality and Individual differences*, *37*(5), 1023-1031.

Feldman, K. A., & Newcomb, T. M. (1969). *The impact of college on students* (Vol. 1). San Francisco: Jossey-Bass.

Fulmer, C. A., Gelfand, M. J., Kruglanski, A. W., Kim-Prieto, C., Diener, E., Pierro, A., & Higgins, E. T. (2010). On "feeling right" in cultural contexts: How person-culture match affects self-esteem and subjective well-being. *Psychological Science, 21*, 1563–1569. http://dx.doi.org/10 .1177/0956797610384742

Furnham, A., & Cheng, H. (2015). Associations between education, gender, social class personality traits, and religious faith and service attendance in a British cohort. *Personality and Individual Differences*, *86*, 63–66. https://doi.org/10.1016/j.paid.2015.06.014

Gebauer, J. E., Bleidorn, W., Gosling, S. D., Rentfrow, P. J., Lamb, M. E., & Potter, J. (2014). Cross-cultural variations in big five relationships with religiosity: A sociocultural motives

perspective. *Journal of Personality and Social Psychology, 107*(6), 1064-1091. doi:http://dx.doi.org/10.1037/a0037683

Gebauer, J. E., Paulhus, D. L., & Neberich, W. (2013). Big Two personality and religiosity across cultures: Communals as religious conformists and agentics as religious contrarians. *Social Psychological and Personality Science, 4*, 21–30. doi:10.1177/1948550612442553

Goldberg, L. R. (1992). The development of markers of the Big-Five factor structure. *Psychological Assessment, 4,* 26-42.

Good, M., Willoughby, T., & Busseri, M. A. (2011). Stability and Change in Adolescent Spirituality/Religiosity: A Person-Centered Approach. *Developmental Psychology*, *47*(2), 538–550. https://doi.org/10.1037/a0021270

Hamaker, E. L., Kuiper, R. M., & Grasman, R. P. P. P. (2015). A critique of the cross-lagged panel model. *Psychological Methods*, *20*(1), 102–116. https://doi.org/10.1037/a0038889

Heaven, P. C. L., & Ciarrochi, J. (2007). Personality and religious values among adolescents: A three-wave longitudinal analysis. *British Journal of Psychology, 98*(4), 681–694. https://doi.org/10.1348/ 000712607X187777

Hildebrandt, A., Lüdtke, O., Robitzsch, A., Sommer, C., & Wilhelm, O. (2016). Exploring Factor Model Parameters across Continuous Variables with Local Structural Equation Models. *Multivariate Behavioral Research*, *51*(2–3), 257–258. https://doi.org/10.1080/00273171.2016.1142856

Hill, P. C., & Hood, R. W. (Eds.). (1999). *Measures of religiosity* (pp. 119-58). Birmingham, AL: Religious Education Press.

Holm, S. (1979). A simple sequentially rejective multiple test procedure. *Scandinavian Journal of Statistics*, *6*, 65–70.

Huuskes, L., Ciarrochi, J., & Heaven, P. C. L. (2013). The longitudinal relationships between adolescent religious values and personality. *Journal of Research in Personality*, *47*(5), 483–487. https://doi.org/10.1016/j.jrp.2013.04.010

Inglehart, R., C. Haerpfer, A. Moreno, C. Welzel, K. Kizilova, J. Diez-Medrano, M. Lagos, P. Norris, E. Ponarin & B. Puranen et al. (eds.). (2014). *World Values Survey: All Rounds - Country-Pooled Datafile 1981-2014*. Madrid: JD Systems Institute.

Inzlicht, M., Tullett, A. M., & Good, M. (2011). The need to believe: a neuroscience account of religion as a motivated process. *Religion, brain & behavior*, *1*(3), 192-212.

John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm shift to the integrative Big Five trait taxonomy: History, measurement, and conceptual issues. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (pp. 114–158). The Guilford Press.

King, P. E., & Boyatzis, C. J. (2004). Exploring adolescent spiritual and religious development: Current and future theoretical and empirical perspectives. *Applied Developmental Science, 8*, 2–6.

King, V., Elder Jr, G. H., & Whitbeck, L. B. (1997). Religious involvement among rural youth: An ecological and life-course perspective. *Journal of Research on Adolescence*, *7*(4), 431-456. https://doi.org/10.1207/s15327795jra0704_5

Koenig, L. B., McGue, M., & Iacono, W. G. (2008). Stability and Change in Religiousness During Emerging Adulthood. *Developmental Psychology*, *44*(2), 532–543. https://doi.org/10.1037/0012-1649.44.2.532

Kosek, R. B. (1999). Adaptation of the Big Five as a hermeneutic instrument for religious constructs. *Personality and Individual Differences*, *27*(2), 229–237. https://doi.org/10.1016/S0191-8869(98)00235-9

Krauss, S., Orth, U., & Robins, R. W. (2020). Family environment and self-esteem development: A longitudinal study from age 10 to 16. *Journal of Personality and Social Psychology*, *119*(2), 457–478. https://doi.org/10.1037/pspp0000263

Lace, J. W., Evans, L. N., Merz, Z. C., & Handal, P. J. (2020). Five-factor model personality traits and self-classified religiousness and spirituality. *Journal of Religion and Health, 59*(3), 1344-1369. doi:http://dx.doi.org/10.1007/s10943-019-00847-1

Löckenhoff, C. E., Ironson, G. H., O'Cleirigh, C., & Costa, P. T. (2009). Five-factor model personality traits, spirituality/religiousness, and mental health among people living with HIV. *Journal of Personality*, *77*(5), 1411–1436. https://doi.org/10.1111/j.1467-6494.2009.00587.x

Lodi-Smith, J., & Roberts, B. W. (2007). Social investment and personality: A meta-analysis of the relationship of personality traits to investment in work, family, religion, and volunteerism. *Personality and Social Psychology Review, 11*(1), 1-19. doi:http://dx.doi.org/10.1177/1088868306294590

Lucas, R. E. (2022). It's time to abandon the cross-lagged model. Preprint. https://doi.org/10.31234/osf.io/pkec7

Ludeke, S. G., & Carey, B. (2015). Two mechanisms of biased responding account for the association between religiousness and misrepresentation in Big Five self-reports. *Journal of Research in Personality*, *57*, 43–47. https://doi.org/10.1016/j.jrp.2015.03.003

Maltby, J., & Day, L. (2001). Spiritual involvement and belief: the relationship between spirituality and Eysenck's personality dimensions. *Personality and Individual Differences*, *30*(2), 187-192.

Maslow, A. H. (1964). Religions, values, and peak-experiences. New York: Viking.

McCullough, M. E., Enders, C. K., Brion, S. L., & Jain, A. R. (2005). The varieties of religious development in adulthood: A longitudinal investigation of religion and rational choice. *Journal of Personality and Social Psychology, 89*(1), 78-89. doi:http://dx.doi.org/10.1037/0022-3514.89.1.78

McCullough, M. E., & Polak, E. L. (2007). Change and stability during the third age. In J. James & P. Wink (Eds.), *The crown of life: Dynamics of the early postretirement period* (pp. 175–192). New York: Springer Publishing Co.

McCullough, M. E., Tsang, J. A., & Brion, S. (2003). Personality traits in adolescence as predictors of religiousness in early adulthood: Findings from the terman longitudinal study. *Personality and Social Psychology Bulletin*, *29*(8), 980–991. https://doi.org/10.1177/0146167203253210

McCullough, M. E., & Willoughby, B. L. B. (2009). Religion, self-regulation, and self-control: Associations, explanations, and implications. *Psychological Bulletin, 135*(1), 69-93. doi:http://dx.doi.org/10.1037/a0014213

Mroczek, D. K., & Spiro, A. (2003). Modeling intraindividual change in personality traits: Findings from the normative aging study. *Journals of Gerontology - Series B Psychological Sciences and Social Sciences*, *58*(3). https://doi.org/10.1093/geronb/58.3.P153

Osborne, D., & Sibley, C. G. (2020). Does openness to experience predict changes in conservatism? A nine-wave longitudinal investigation into the personality roots to ideology. *Journal of Research in Personality*, *87*, 103979.

Pew Research Center. (2015). *The Future of World Religions: Population Growth Projections, 2010-2050* [Table]. Retrieved from https://www.pewforum.org/2015/04/02/religious-projection-table/2010/percent/all/

Roberts, B. W., Caspi, A., & Moffitt, T. E. (2001). The kids are alright: Growth and stability in personality development from adolescence to adulthood. Journal of Personality and *Social Psychology, 81*, 670–683.

Roberts, B. W., & Mroczek, D. (2008). Personality trait change in adulthood. *Current Directions in Psychological Science*, *17*(1), 31–35. https://doi.org/10.1111/j.1467-8721.2008.00543.x

Roberts, B. W., Walton, K. E., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychological Bulletin*, *132*(1), 1–25. https://doi.org/10.1037/0033-2909.132.1.1

Rogosa, D. (1980). A critique of cross-lagged correlation. *Psychological bulletin*, *88*(2), 245.

Saroglou, V. (2002). Religion and the five factors of personality: A meta-analytic review. *Personality and Individual Differences*, *32*(1), 15–25. https://doi.org/10.1016/S0191-8869(00)00233-6

Saroglou, V. (2010). Religiousness as a cultural adaptation of basic traits: A five-factor model perspective. *Personality and Social Psychology Review, 14*(1), 108-125. doi:http://dx.doi.org/10.1177/1088868309352322

Saroglou, V. (2011). Believing, bonding, behaving, and belonging: The big four religious dimensions and cultural variation. *Journal of Cross-Cultural Psychology, 42*, 1320–1340. https://doi. org/10.1177/0022022111412267

Saroglou, V., Clobert, M., Cohen, A. B., Johnson, K. A., Ladd, K. L., Van Pachterbeke, M., Adamovova, L., Blogowska, J., Brandt, P. Y., Çukur, C. S., Hwang, K. K., Miglietta, A., Motti-Stefanidi, F., Muñoz-García, A., Murken, S., Roussiau, N., & Tapia Valladares, J. (2020). Believing, Bonding, Behaving, and Belonging: The Cognitive, Emotional, Moral, and Social Dimensions of Religiousness across Cultures. *Journal of Cross-Cultural Psychology*, *51*(7–8), 551–575. https://doi.org/10.1177/0022022120946488

Saroglou, V., & Muñoz-garcía, A. (2008). Individual differences in religion and spirituality: An issue of personality traits and/or values. *Journal for the Scientific Study of Religion*, *47*(1), 83–101. https://doi.org/10.1111/j.1468-5906.2008.00393.x

Saucier, G., & Skrzypińska, K. (2006). Spiritual but not religious? Evidence for two independent dispositions. *Journal of Personality*, *74*, 1257–1292. https://doi.org/10.1111/j.1467-6494.2006.00409.x

Scherpenzeel, A., Das, J. W. M., Ester, P., & Kaczmirek, L. (2010). 'True' longitudinal and probability-based internet panels: Evidence from the Netherlands. In Das, J. W. M., Ester, P., Kaczmirek, L. (Eds.), *Social and behavioral research and the Internet* (pp. 77–103). Taylor & Francis.

Schnitker, S. A., Williams, E. G., & Medenwaldt, J. M. (2021). Personality and social psychology approaches to religious and spiritual development in adolescents. *Adolescent Research Review*, *6*(3), 289-307.

Schwaba, T., & Bleidorn, W. (2018). Individual differences in personality change across the adult life span. *Journal of Personality*, *86*(3), 450–464. https://doi.org/10.1111/jopy.12327

Schwaba, T., Bleidorn, W., Hopwood, C. J., Manuck, S. B., & Wright, A. G. C. (in press). Refining the maturity principle of personality development by examining facets, close others, and co-maturation. *Journal of Personality and Social Psychology.*

Schwaba, T., Luhmann, M., Denissen, J. J. A., Chung, J. M., & Bleidorn, W. (2018). Openness to experience and culture-openness transactions across the lifespan. *Journal of Personality and Social Psychology, 115*(1), 118–136. https://doi.org/10.1037/pspp0000150

Schwadel, P. (2015). Explaining cross-national variation in the effect of higher education on religiosity. *Journal for the Scientific Study of Religion*, *54*(2), 402-418.

Schwartz, S. H., & Huismans, S. (1995). Value priorities and religiosity in four Western religions. *Social Psychology Quarterly, 58*, 88–107. doi: 10.2307/2787148

Stark, R. (2002). Physiology and faith: Addressing the "universal" gender difference in religious commitment. *Journal for the Scientific Study of Religion, 41*, 495–507.

Stavrova, O., Fetchenhauer, D., & Schlösser, T. (2013). Why are religious people happy? The effect of the social norm of religiosity across countries. *Social science research*, *42*(1), 90-105.

Stoppa, T. M., & Lefkowitz, E. S. (2010). Longitudinal changes in religiosity among emerging adult college students. *Journal of Research on Adolescence*, *20*(1), 23–38. https://doi.org/10.1111/j.1532-7795.2009.00630.x

Streib, H., Chen, Z. J., & Hood Jr, R. W. (2021). Faith development as change in religious types: Results from three-wave longitudinal data with faith development interviews. *Psychology of Religion and Spirituality*.

Stronge, S., Bulbulia, J., Davis, D. E., & Sibley, C. G. (2020). Religion and the development of character: Personality changes before and after religious conversion and deconversion. *Social Psychological and Personality Science*, *12*(5), 801-811.

R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Rosseel, Y. (2012). "lavaan: An R Package for Structural Equation Modeling." *Journal of Statistical Software*, *48*(2), 1–36. doi: 10.18637/jss.v048.i02.

Taylor, A., & MacDonald, D. A. (1999). Religion and the five factor model of personality: An exploratory investigation using a Canadian university sample. *Personality and Individual Differences*, *27*(6), 1243–1259. https://doi.org/10.1016/S0191-8869(99)00068-9

Ter Kuile, H., & Ehring, T. (2014). Predictors of changes in religiosity after trauma: Trauma, religiosity, and posttraumatic stress disorder. *Psychological Trauma: Theory, Research, Practice, and Policy*, *6*(4), 353–360. https://doi.org/10.1037/a0034880

Terracciano, A., McCrae, R. R., Brant, L. J., & Costa, P. T., Jr. (2005). Hierarchical linear modeling analyses of the NEO-PI-R scales in the Baltimore Longitudinal Study of Aging. *Psychology and Aging, 20*, 493–506

Wink, P., Ciciolla, L., Dillon, M., & Tracy, A. (2007). Religiousness, spiritual seeking, and personality: Findings from a longitudinal study. *Journal of Personality, 75*(5), 1051-1070. doi:http://dx.doi.org/10.1111/j.1467-6494.2007.00466.x

Wortman, J., Lucas, R. E., & Donnellan, M. B. (2012). Stability and change in the Big Five personality domains: Evidence from a longitudinal study of Australians. *Psychology and Aging, 27*, 867-874.

Wrzus, C., & Roberts, B. W. (2017). Processes of Personality Development in Adulthood: The TESSERA Framework. *Personality and Social Psychology Review*, *21*(3), 253–277. https://doi.org/10.1177/1088868316652279

Zuckerman, M., Silberman, J., & Hall, J. A. (2013). The relation between intelligence and religiosity: A meta-analysis and some proposed explanations. *Personality and social psychology review*, *17*(4), 325-354.

Supplemental Material

Results

Longitudinal associations between personality and religiosity

Fit statistics for all CLPMs are listed in Table S1. Overall, the models had adequate fit with CFI > .85 and RMSEA < .08. The standardized between-person cross-lagged estimates from the CLPMs are shown in Table S2. Paths did not vary in magnitude across time, and thus only one estimate per each variable (e.g., personality predicting religiosity and vice versa) is listed in the table for each model.

All Big Five traits were associated with at least one religiosity variable, however, these associations differed in magnitude and direction. Overall, the absolute magnitude of the cross-lagged effect sizes was small, ranging from -.006 (extraversion predicting subsequent service attendance) to .018 (agreeableness predicting subsequent belief in God). With regard to personality, we found the strongest effects for agreeableness and openness, which also were the only traits that had reciprocal associations with all three religiosity variables. With regard to religiosity, we found the strongest effects for belief in God relative to the other religiosity variables.

Agreeableness was positively associated with religiosity, such that people who were higher in their levels of agreeableness relative to others were subsequently higher in their levels of religiosity compared to others and vice versa. Openness was negatively associated with religiosity, such that people who were higher in their levels of openness relative to others were subsequently lower in their levels of religiosity relative to others and vice versa. The remaining Big Five had only prospective (but not reciprocal) effects on at least one religiosity variable. Conscientiousness was positively associated with all three religiosity variables, such that people

who were higher in their levels of conscientiousness relative to others were subsequently higher in their levels of religiosity relative to others. Emotional stability and extraversion were both negatively associated with religiosity. People who were higher in their levels of emotional stability relative to others were subsequently lower in their levels of belief in God relative to others; people who were higher in their levels of extraversion relative to others were subsequently lower in their levels of service attendance relative to others.

Table S1

Fits for CLPM and RI-CLPM

	Belief in God						Service Attendance						Prayer					
	CFI	RMSEA	AIC	χ^2	df	p	CFI	RMSEA	AIC	χ^2	df	p	CFI	RMSEA	AIC	χ^2	df	p
Emotional Stability																		
CLPM	.861	.072	261791	15326	226		.883	.070	218490	14447	226		.901	.067	269019	13170	226	
RI-CLPM	.989	.021	247913	1442	223		.987	.023	205797	1748	223		.986	.025	257919	2064	223	
Model Comparison (Δ)	.128	.051	13878	13884	3	< .001	.104	.047	12693	12699	3	< .001	.085	.042	11100	11106	3	< .001
Extraversion																		
CLPM	.866	.073	250311	15707	226		.886	.071	206987	14888	226		.903	.068	257517	13594	226	
RI-CLPM	.991	.019	235884	1275	223		.989	.022	193739	1633	223		.988	.024	245867	1939	223	
Model Comparison (Δ)	.125	.054	14427	14432	3	< .001	.103	.049	13248	13255	3	< .001	.085	.044	11650	11655	3	< .001
Openness																		
CLPM	.854	.074	234621	16203	226		.876	.072	191374	15345	226		.894	.069	241886	14057	226	
RI-CLPM	.992	.017	219512	1088	223		.990	.020	177438	1403	223		.988	.023	229571	1736	223	
Model Comparison (Δ)	.138	.057	15109	15115	3	< .001	.114	.052	13936	13942	3	< .001	.094	.046	12315	12321	3	< .001
Agreeableness																		
CLPM	.851	.073	239591	15742	226		.875	.071	196336	14842	226		.894	.068	246842	13628	226	
RI-CLPM	.990	.019	225114	1259	223		.988	.022	183102	1602	223		.986	.024	235152	1933	223	
Model Comparison (Δ)	.139	.054	14477	14483	3	< .001	.113	.049	13234	13240	3	< .001	.092	.044	11690	11695	3	< .001
Conscientiousness																		
CLPM	.857	.072	240857	15570	226		.880	.070	197542	14634	226		.898	.067	248058	13409	226	
RI-CLPM	.990	.019	226597	1303	223		.989	.022	184484	1570	223		.987	.024	236566	1911	223	
Model Comparison (Δ)	.133	.053	14260	14267	3	< .001	.109	.048	13058	13064	3	< .001	.089	.043	11492	11498	3	< .001

Note. Model comparison (Δ) indicates the absolute change in fit indices between CLPM and RI-CLPM; p-value is in reference to the χ^2 difference test between the CLPM and RI-CLPM. AIC and χ^2 values rounded to nearest integer.

Table S2

Cross-Lagged Panel Model Results

	Belief in God			Service Attendance			Prayer		
	Estimate	*p*	95% CI	Estimate	*p*	95% CI	Estimate	*p*	95% CI
Emotional Stability									
Religiosity → Trait	-.003	.174	-.008, .001	.002	.355	-.002, .007	-.001	.731	-.005, .004
Trait → Religiosity	**-.008**	.001	-.012, -.003	.002	.317	-.002, .006	-.001	.618	-.005, .003
Extraversion									
Religiosity → Trait	-.002	.428	-.006, .002	-.001	.698	-.005, .003	.000	.892	-.004, .004
Trait → Religiosity	-.006	.016	-.010, -.001	**-.006**	.003	-.010, -.002	-.004	.018	-.008, -.001
Openness									
Religiosity → Trait	**-.016**	< .001	-.021, -.011	**-.007**	.001	-.012, -.003	**-.007**	.001	-.012, -.003
Trait → Religiosity	**-.015**	< .001	-.019, -.010	**-.008**	< .001	-.012, -.004	**-.008**	< .001	-.011, -.004
Agreeableness									
Religiosity → Trait	**.013**	< .001	.008, .018	**.007**	.007	.002, .011	**.009**	< .001	.004, .014
Trait → Religiosity	**.018**	< .001	.014, .023	**.007**	.002	.003, .011	**.008**	< .001	.004, .012
Conscientiousness									
Religiosity → Trait	-.002	.339	-.007, .002	.001	.714	-.004, .005	.000	.870	-.004, .005
Trait → Religiosity	**.009**	< .001	.004, .014	**.008**	< .001	.003, .012	**.008**	< .001	.004, .012

Note. Cross-lagged estimates were consistent across the 11 waves and thus only one estimate per model is provided. Bolded values indicate $p < .01$.

Table S3

Summary of cross-lagged effects across CLPM and RI-CLPM

	Belief in God		**Service Attendance**		**Prayer**	
	B5 → R	R → B5	B5 → R	R → B5	B5 → R	R → B5
Emotional Stability						
CLPM	-X					
RI-CLPM						
Extraversion						
CLPM			-X			
RI-CLPM	X					
Openness						
CLPM	-X	-X	-X	-X	-X	-X
RI-CLPM						
Agreeableness						
CLPM	X	X	X	X	X	X
RI-CLPM	X	X				
Conscientiousness						
CLPM	X		X		X	
RI-CLPM						

Note. B5 refers to Big Five personality trait; R refers to religiosity indicator. X marks a significant effect at $p < .01$. A negative sign (-) preceding an X represents a negative effect.

Table S4

Baseline Correlations Between Religiosity Aspects

	Belief in God	Service Attendance	Prayer
Belief in God	-		
Service Attendance	.59	-	
Prayer	.71	.70	-

Note. All correlations significant at $p < .001$ after using Holm's correction for multiple comparisons.