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RESEARCH

How Chanting Enhances Well-Being: The Roles of Vocalization, Repetition, and Concentration

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Abstract

Objectives Chanting – continually repeating a chosen sound while passively disregarding any distractions – is positively associated with well-being, yet its specific mechanisms and optimal conditions remain unclear. This study examines three elements of chanting (i.e., vocalization, repetition, and concentration), their effects on subjective well-being (SWB), and the mediating roles of rumination, flow, and mystical states of consciousness.

Method In a 2x2x2 mixed factorial design, participants (N=248) were randomly assigned to one of four between-subjects conditions (vocal vs. silent, repeated vs. variable sounds) with within-group variation from Week 1 to Week 2 (no-prompt vs. high-concentration prompt). We hypothesized that participants in conditions with more of the three chanting elements would report higher SWB, lower heart and respiration rates, a more immersive chanting experience, reduced rumination, more flow, and more mystical states. We used multilevel modeling to test which conditions lead to changes in SWB and mediators.

Results Chanting increased SWB and immersion over the 2-week intervention, particularly in the concentration condition. Furthermore, when participants chanted with concentration, mystical states partially mediated the relation between chanting and heart rate. Chanting was not significantly associated with changes in heart or respiration rates overall, and vocalization and repetition were not associated with differences in SWB. Additionally, neither rumination nor flow mediated the effects of chanting on SWB.

Conclusions This study highlights the potential role of chanting in fostering well-being and illuminates its psychological and physiological processes. By isolating specific elements of chanting, this study provides the first experimental evidence of how chanting may affect well-being.

Keywords Well-being · Chanting · Spirituality · Rumination · Flow · Mystical experience

Spiritual practices have been linked to well-being for millennia. Ancient Hindu texts recommended breathwork practices to promote mental clarity (Sargeant, 2009). Early Christian monastic communities, such as the Benedictines, emphasized prayer, meditation, and communal rituals as pathways to well-being (Casey, 2005). Navajo spiritual ceremonies were believed to promote harmony, balance, and protection from illness (Spilka, 2005). Across traditions, such practices have typically served regulatory, ritualistic, and communal functions, rather than being explicitly designed to increase well-being (Hobson et al., 2018; Wood, 2017). Nevertheless, contemporary research indicates that both religion and spirituality are positively associated with well-being (Kim-Prieto & Miller, 2018; Van Cappellen et al., 2023). For example, a recent meta-analysis found that spirituality has a moderately strong, positive association with life satisfaction ($r = 0.30$; Yaden et al., 2022).

Experimental interventions, in which people are prompted to engage in different positive practices, have also been shown to promote well-being. Many studies have demonstrated that positive interventions can promote psychological benefits (Carr et al., 2021; Sin & Lyubomirsky, 2009). For example, in a well-powered experiment, participants who were randomly assigned to make a purchase for a stranger in need (vs. themselves) reported higher levels of subjective well-being (SWB; Aknin et al., 2020). In another

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experiment, participants asked to express gratitude reported higher levels of SWB than those asked to track their daily activities (Walsh et al., 2023).

Despite these well-established connections, relatively little attention has been given to isolating specific spiritual practices as interventions to foster well-being. This is especially surprising, given that many Americans claim that some form of spirituality is important in their lives, and over 25% identify as spiritual but not religious (SBNR; Pew Research Center, 2023). Although some spiritual practices, such as yoga and meditation, have been studied for their relation with physical and mental health (Büssing et al., 2012), other practices remain underexplored. Chanting—a common meditative technique, practiced worldwide across cultures and traditions—is one such practice. Compared to yoga and meditation, chanting is low-effort, easily accessible, and requires no specialized training, making it a promising target for intervention research.

Chanting involves continually repeating a chosen word, phrase, or set of syllables while passively disregarding any internal or external distractions (Lynch et al., 2018). This definition encompasses silent or internal repetition, which is consistent with mantra-based practices across contemplative traditions. This definition also distinguishes chanting from music, which is broadly defined as a social form of art (Trehub et al., 2015). Whereas previous work has explored the psychological and health benefits of music (MacDonald et al., 2013), this study focuses on the benefits of chanting. We identify three key elements inherent in the definition by Lynch et al.: vocalization (spoken aloud), repetition (repeated sounds), and concentration (focused attention), each of which may engage distinct attentional and experiential processes. Vocalization may increase embodied engagement and auditory feedback; repetition may reduce cognitive load; and concentration may deepen attentional focus. These elements are evident in cultural forms of chanting across both Eastern and Western spiritual traditions (Apel, 1958; Beck, 2019; Harvey, 2012). These elements are also suitable for experimental manipulation. As virtually no empirical work exists on this topic, this study aims to identify and unpack these key elements.

Preliminary evidence suggests that chanting could improve well-being. Experimental work has shown that chanting reduces negative affect (Perry et al., 2023), increases positive affect (Simpson et al., 2021), and may influence physiological states such as heart rate and respiration (Bernardi et al., 2001). For example, patients with memory loss experienced boosts in mood and decreases in anxiety after an 8-week, 12-min per day chanting meditation program (Moss et al., 2012). However, much of this work is limited to clinical populations or lacks rigorous experimental controls (Lynch et al., 2018). Compared to meditation and yoga, chanting is under-researched, especially regarding its experimental effects on SWB in non-clinical populations.

Given its simplicity, accessibility, and adaptability to secular or religious contexts, chanting offers several advantages as a well-being intervention. We propose that chanting fosters SWB, in part through reductions in rumination, increases in flow, and greater experiences of mystical states of consciousness. Furthermore, we propose that the effect is more salient if the chanting is vocal, repetitive, and performed with concentration (see Fig. 1), and that participants who experience those three elements will report a more immersive experience, lower heart rates, and lower respiration rates.

Subjective well-being is a global assessment of one's positive and negative affect and life satisfaction (Diener, 1984). Higher SWB is linked to better health, career success, and stronger social ties (Lyubomirsky et al., 2005). Previous research links chanting with increased positive affect and decreased negative affect (Perry et al., 2023; Simpson et al., 2021). Additionally, changes in our proposed mediators (i.e., rumination, flow, and mystical states) may also promote a cognitive assessment that one's life is going well.

Rumination is characterized by repetitive, unproductive thinking about one's feelings and problems (Nolen-Hoeksema et al., 2008). It is linked to negative affect and anxiety (Kirkegaard Thomsen, 2006). Experimental work has shown that rumination intensifies and prolongs negative emotional states (for a review, see Watkins & Roberts, 2020). Chanting may disrupt rumination by directing attention to an ongoing, repetitive task, as has been shown with mindful breathing

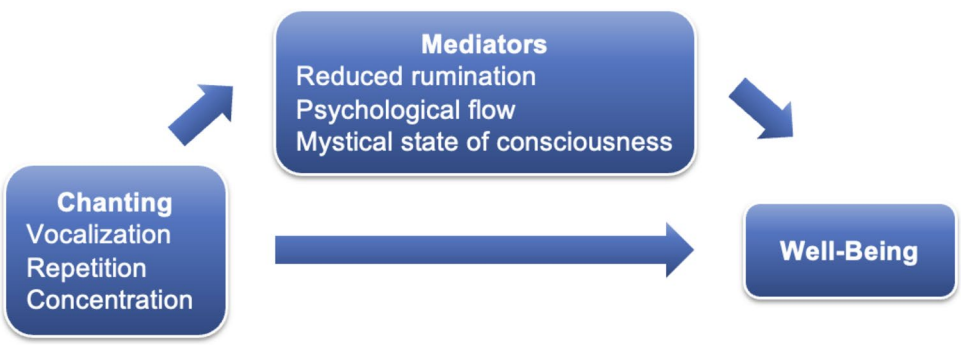


Fig. 1 Chanting and its effects on well-being

(Feldman et al., 2010). Such cognitive engagement may curb distressing thoughts, reduce negative affect, and boost life satisfaction. The effect may be more pronounced in vocal chanting, which requires physical engagement.

Flow is a mental state of complete immersion and engagement in an activity, characterized by energized focus, full involvement, and intrinsic enjoyment (Nakamura & Csikszentmihalyi, 2014). Flow has been consistently associated with positive affect (Csikszentmihalyi & Larson, 2014), with positive correlations reported at work (Fullagar & Kelloway, 2009), at school (Rogatko, 2009), and at home (Collins et al., 2009). Chanting's repetitive and immersive nature may promote flow, as it demands concentration and provides clear, immediate feedback. By boosting flow, chanting may also foster mastery and pleasure and therefore increase SWB (Ryan & Deci, 2000). The effect may be more pronounced if concentration is emphasized, given that activities requiring focused attention are more likely to induce flow (Csikszentmihalyi & Larson, 2014).

Altered states of consciousness are psychological states distinct from ordinary waking consciousness (American Psychological Association, n.d.). One variety of altered state is a mystical state, which is characterized by positivity, meaning, and a powerful sense of contact with a reality beyond ordinary sensory experience (Wulff, 2014). In one study, participants with a regular chanting practice who reported higher intentionality and engagement in their practice were more likely to experience mystical states (Perry et al., 2022). Furthermore, mystical states are positively linked to well-being (Griffiths et al., 2019; Yaden et al., 2017). Chanting's rhythm, repetition, and sustained attentional demands may trigger mystical states (Perry et al., 2021). The deep sense of peace, meaning, and positivity of mystical states (Millière et al., 2018) could be a key differentiator between chanting and other musical experiences.

Changes in physiological indicators like heart rate and respiration rate have been observed in chanting and other spiritual practices (Bernardi et al., 2001). For example, a recent review found that regular yoga practitioners exhibit lower basal oxygen consumption compared to non-practitioners (Tyagi & Cohen, 2013). Decreases in heart and respiration rates may reflect changes in physiological arousal during chanting (Krygier et al., 2013). Furthermore, recent work links rumination (Ottaviani et al., 2016), flow (Peifer & Tan, 2021), and altered states of consciousness (Rosas et al., 2023) with changes in heart rate.

The present study investigated the elements of chanting (i.e., vocalization, repetition, and concentration), their effects on SWB and physiological measures, and whether these effects are mediated by rumination, flow, and mystical states. We hypothesized that participants in conditions incorporating more of these chanting elements would report (a) higher SWB; (b) lower heart and respiration rates; (c) a more immersive chanting experience; and (d) reduced rumination, more flow, and more mystical states, relative to conditions incorporating fewer elements. We further hypothesized that rumination, flow, and mystical states would partially mediate the effects of chanting on SWB and related outcomes. The present study also explored demographics (e.g., spirituality) and personality (e.g., openness to experience) as possible moderators of these effects (Lyubomirsky & Layous, 2013).

Method

Participants

Participants ($n = 248$; $M_{age} = 19.55$, $SD = 2.45$) were undergraduates at a large, public university in southern California. They received course credit for their participation. We aimed to recruit 50–75 participants per condition (target $N = 300$) to account for possible attrition. A sample size of 200 is sufficient to detect a small, direct effect at 80% power in a two-level multilevel model (Arend & Schäfer, 2019). Furthermore, larger samples enhance precision, reduce false positives, and support replicability (Fraley & Vazire, 2014). The final sample consisted of 248 participants. The majority of participants identified as female (59.7%) and Hispanic/Latino (39.5%), followed by Asian (36.7%), and then White (8.5%). See Table S1 in Supplementary Information for a comprehensive report of participant demographics.

Procedure

Participants were recruited online through a student participant pool. All instructions and measures were administered online via Qualtrics. After giving informed consent, participants provided demographic information and baseline measures. They were asked to find a quiet, private place to sit where they would not be disturbed while they completed a 5-min task. They completed one online assessment and task per day for 14 consecutive days (Fig. 2). Each assessment was delivered via email. It included self-report measures and the task instructions. Participants were not told that the task was chanting or that the study involved chanting. They could enroll on a rolling basis until 14 days before the study credit deadline or until we reached the target sample size. The study was launched on November 14, 2024, and the final survey was completed on December 6, 2024. Not all participants completed every survey, resulting in variable sample sizes across time points. See Table S2 for sample size per condition at each time point.

This study used a 2×2x2 mixed factorial design with repeated measures. The two between-subjects factors were repetition and vocalization. Participants were asked to either repeat the same sound or chant different sounds, and they

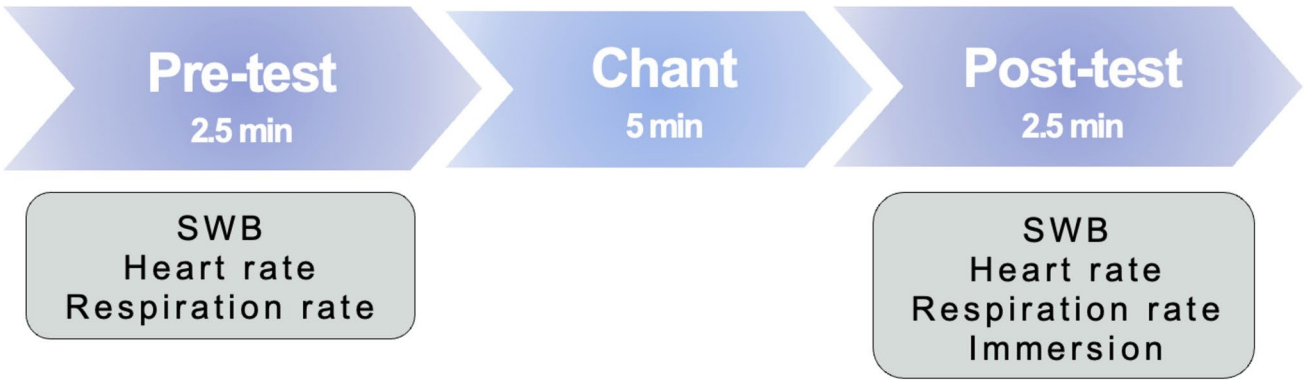


Fig. 2 Daily schedule and measures

were asked to do so either vocally or silently. In all conditions, stimuli were presented on screen to ensure consistency in visual input across tasks. For example, participants in the Vocal/Repeated condition were instructed to say "lahm" aloud for 5 min. By contrast, in the Vocal/Varied condition, participants recited different sounds aloud (e.g., "lahm," "kay," "soh") displayed on a screen and changing every 8 s.

This approach aimed to introduce variability while keeping the timing and structure of the task consistent across participants. This interval was selected to approximate the pacing of common chanting practices while still remaining manageable for first-time participants. Finally, these particular syllables were selected for their phonetic simplicity and lack of strong semantic associations.

In the Silent/Repeated condition, participants silently repeated "lahm" in their minds for 5 min, while those in the Silent/Varied condition silently repeated a series of different sounds appearing on the screen every 8 s.

These factors created four between-subjects experimental groups: Vocal/Repeated ($n=59$), Vocal/Varied ($n=60$), Silent/Repeated ($n=64$), and Silent/Varied ($n=65$). Participants were randomly assigned to one of these groups.

The within-subjects factor was concentration. During Week 1, participants did not receive a concentration prompt, while during Week 2, participants received a prompt to concentrate on the experience (i.e., "be fully focused on the experience, noticing how the sound influences both your mental state and physical sensations"). This factor created two within-subjects conditions: No Prompt (Week 1) and High-Concentration Prompt (Week 2), applied across all four experimental groups (Fig. 3).

An audio clip of chanting was provided to each condition to demonstrate the desired pitch, length, and volume. Because pitch, length, and volume are relatively harder to manipulate, we opted to control these elements of chanting. See Tables S3-S5 for complete condition instructions, a link to the example audio clip, and the full list of sounds in the Varied conditions. The preregistered study design is available at https://osf.io/y5vqk/. This study was approved by the university's Institutional Review Board.

Measures

Personality Personality traits were measured using the 30-item Big Five Inventory-2 Short Form (Soto & John, 2017). The measure includes five subscales: openness (e.g., "I have a vivid imagination"), extraversion (e.g., "I am the life of the party"), negative emotionality (e.g., "I get stressed out easily"), conscientiousness (e.g., "I am always

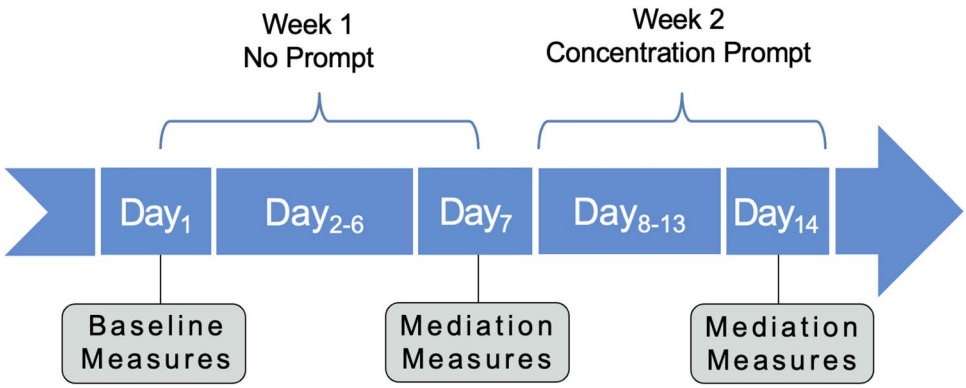


Fig. 3 Weekly schedule and measures

prepared"), and agreeableness (e.g., "I sympathize with others' feelings"). Responses ranged from "disagree strongly" (1) to "agree strongly" (5). This measure was administered on Days 1, 7, and 14.

Rumination Rumination was assessed using the 8-item Brief State Rumination Inventory (e.g., "Right now, it is hard for me to shut off negative thoughts about myself"; Marchetti et al., 2018). Items were measured on a 100-mm Visual Analogue Scale (VAS) ranging from "completely disagree" (0) to "completely agree" (100). This measure was administered on Days 1, 7, and 14.

Flow Psychological flow was measured using the 9-item Psychological Flow Scale (Norsworthy et al., 2023). The measure includes three subscales: absorption (3 items; e.g., "I was absorbed in the act/task"), effortless control (3 items; e.g., "My actions flowed effortlessly"), and intrinsic reward (3 items; e.g., "I found the experience rewarding"). Responses ranged from "strongly disagree" (1) to "strongly agree" (7). This measure was administered on Days 7 and 14.

Mystical States of Consciousness Mystical states were measured using the 4-item Mystical Experience Questionnaire Brief (e.g., "Rate the degree to which you experienced a transcendence of time and space"; Strickland et al., 2024), as well as 7 items from the 30-item Revised Mystical Experience Questionnaire (e.g., "Rate the degree to which you experienced a sense of reverence"; Barrett et al., 2015). Responses ranged from "none" (0) to "extreme" (6). This measure was administered on Days 7 and 14.

Positive and Negative Affect Positive and negative affect were assessed using the Modified Affect Adjective Scale (Diener & Emmons, 1984), which includes 7 positive and 6 negative emotions (e.g., "happy," "joyful," "sad," "unpleasant"). Responses ranged from "not at all" (1) to "extremely" (7). This measure was administered on Days 1, 7, and 14.

Life Satisfaction Life satisfaction was measured using the 5-item Satisfaction With Life Scale (e.g., "I am satisfied with my life"; Diener et al., 1985). Responses ranged from "strongly disagree" (1) to "strongly agree" (7). This measure was administered on Days 1, 7, and 14.

Global Mood and Life Satisfaction Mood and life satisfaction were assessed using the 2-item Global Mood and Life Satisfaction Sliders (i.e., "How do you feel right now," "How satisfied with your life are you right now"; Jacobs Bao, 2012). Items were measured on a 100-mm Visual Analogue Scale (VAS) ranging from "0" (frowning face) to "100" (smiling face). These shorter SWB measures were administered daily. Together, these measures capture both short-term (state-like) fluctuations in affect and more stable, cumulative changes in life satisfaction across the study period.

Immersion Immersion was measured using a 1-item experience measure (e.g., "I was deeply and fully immersed in the experience"). Responses ranged from "strongly disagree" (1) to "strongly agree" (7). This measure was administered daily.

Heart and Respiration Rates Heart and respiration rates were measured by asking participants to count their heartbeats, and separately their breaths, for 30 s. These measures were administered daily.

Adherence Adherence to the study instructions was assessed using one item: "I strictly adhered to all of the instructions given." Responses ranged from "strongly disagree" (1) to "strongly agree" (7). This measure was administered on Days 7 and 14. See Tables S6-S7 for the measurement schedule by day and the full instructions for assessing heart and respiration rates.

Data Analyses

Analyses were conducted using R (Version 4.3.1; R Core Team, 2023)—specifically, the *lme4* (Bates et al., 2015), *lmerTest* (Kuznetsova et al., 2017), *performance* (Lüdecke et al., 2021), *boot* (Canty & Ripley, 2022), *emmeans* (Lenth, 2025), and *mediation* (Tingley et al., 2014) packages. The data were preprocessed prior to analysis to ensure quality and standardization. Analyses were conducted in accordance with the preregistered plan, with additional exploratory analyses included to further examine patterns in the data. Participants who completed fewer than 6 of the 14 chanting sessions were excluded, in accordance with preregistered criteria. Categorical variables were dummy coded or converted to numeric values, and reverse scoring was applied to relevant items (e.g., within personality measures). Composite scores for SWB were computed from positive affect, negative affect, and life satisfaction at Days 1, 7, and 14. Additional composite scores for flow, rumination, and mystical states were calculated at Days 7 and 14. Daily scores were also derived for SWB, heart rate, and respiration rate. Skewness was examined numerically for key variables (e.g., SWB, flow, and rumination) and visually using histograms and density plots. Descriptive statistics were computed to summarize participant demographics. Survey completion patterns were tracked by calculating the percentage of missing data per day and computing the average number of completed sessions per participant across Weeks 1 and 2.

Perceived task difficulty was not assessed or included as a covariate because the chanting tasks were designed to be

brief and comparable in duration, timing, visual presentation, and general task demands across conditions. Although future studies could include perceived difficulty as a manipulation check, we expected any differences in task difficulty to be minimal.

Outliers (±3 *SD*) in self-reported heart rate and respiration rate were identified and removed to maintain data integrity. The average resting heart rate for healthy adults is between 60 and 100 beats per minute (bpm; Avram et al., 2019). In a large-scale study using smart devices ($N = 66{,}788$), the average heart rate was 79 bpm ($SD = 14.5$; Mason et al., 2007). Based on these guidelines, heart rate values falling outside three standard deviations (range: 35.5–122.5 bpm) were excluded. Similarly, the average resting respiration rate for healthy adults is between 12 and 20 breaths per minute (Hartley, 2018). A benchmark analysis of three datasets ($N > 13{,}000$) found a mean respiration rate of 15.4 breaths per minute ($SD = 2.35$; Natarajan et al., 2021). Respiration rate values falling outside three standard deviations (range: 8.35–22.45 breaths per minute) were excluded.

Linear mixed-effects models were fit to examine changes in SWB, mood, life satisfaction, heart rate, respiration rate, and immersion over time. Fixed effects included Day, Vocalization, Repetition, and Concentration, as well as a grand-mean centered pre-score covariate. Random intercepts and slopes were specified to model within-person variability. Model diagnostics were conducted to assess normality, homoscedasticity, and overall model fit. Quadratic and logarithmic transformations of time were tested to explore possible non-linear trends. Interaction effects were tested to assess differential responses across experimental conditions. Variance inflation factors and correlation matrices were examined to assess multicollinearity among predictors. Model performance was evaluated using *AIC*, *BIC*, conditional R^2, and marginal R^2. Post hoc pairwise comparisons were conducted using estimated marginal means, with Bonferroni corrections applied to control the familywise error rate.

Parallel mediation models were used to test whether flow, rumination, or mystical states partially mediated the effects of the dummy-coded main chanting elements—Vocalization, Repetition, and Concentration—on SWB, immersion, and physiological outcomes. Path A models tested whether experimental conditions predicted the mediators, and Path B models tested whether the mediators predicted changes in outcomes. Indirect effects were estimated using the product-of-coefficients method with 1,000 bootstrapped confidence intervals. Moderation analyses were also conducted to examine whether demographic variables or personality traits moderated the effects of chanting on SWB.

Results

Consistent with our hypotheses, on average, across conditions, participants reported significant increases in SWB over time during the 14-day study period ($b = 0.67$, $p < 0.001$; Table S8 and Fig. 4). These results are consistent in models that control for demographics ($b = 0.53$, $p < 0.001$). Higher pre-intervention SWB scores predicted higher post-intervention SWB scores on a daily basis ($b = 0.76$, $p < 0.001$). Substantial variance in baseline SWB was observed between participants ($\tau_{00} = 93.56$), and within-person variability in daily SWB was also notable ($\sigma^2 = 77.34$). The estimated random-effects correlation between SWB and rates of change was near zero ($\rho_{01} = 0.02$), suggesting little evidence that participants with higher initial SWB changed at different rates. The fixed effects accounted for a substantial proportion of variance in SWB (marginal $R^2 = 0.433$), while the full model—including random effects for individual differences—explained the majority of variability (conditional $R^2 = 0.807$). Mood ($b = 0.46$, $p < 0.001$) and life satisfaction ($b = 0.26$, $p < 0.001$) also increased over time (Tables S9-S10).

Contrary to hypotheses, chanting did not significantly affect daily heart rate ($b = -0.16$, $p = 0.116$; Table S11 and Figure S1). Similarly, chanting did not significantly affect daily respiration rate ($b = 0.03$, $p = 0.114$; Table S12 and Figure S2). Participants on average reported a more immersive experience over time during the 14-day study period ($b = 0.03$, $p < 0.001$; Table S13 and Figure S3).

Consistent with our hypotheses, participants reported significantly higher levels of SWB when concentrating on chanting ($b = 4.10$, $p < 0.001$; Table S14 and Fig. 5). These results are consistent in models that control for demographics ($b = 3.47$, $p < 0.001$). However, vocal chanting did not significantly increase SWB compared to silent chanting ($b = -1.24$, $p = 0.571$), and repetition of a single sound did not significantly increase SWB relative to varied sounds ($b = -2.90$, $p = 0.180$). Consistent with hypotheses, mood ratings were significantly higher in the vocal chanting condition compared to the silent condition ($b = 3.56$, $p = 0.034$; Table S9). However, the rates of mood increases were significantly smaller in the vocal condition than in the silent condition ($b = -0.35$, $p = 0.009$). Comprehensive SWB assessments administered on Days 1, 7, and 14 did not replicate the patterns observed in daily SWB measures (Tables S15-S18).

Consistent with our hypotheses, post hoc contrasts revealed that participants in the vocal/repeated/concentration condition reported significantly higher levels of SWB on average than participants in all other conditions combined ($b = 4.97$, $p = 0.002$; Table S19). During the concentration week, SWB was significantly higher in the vocal condition than in the silent condition, but only when they repeated

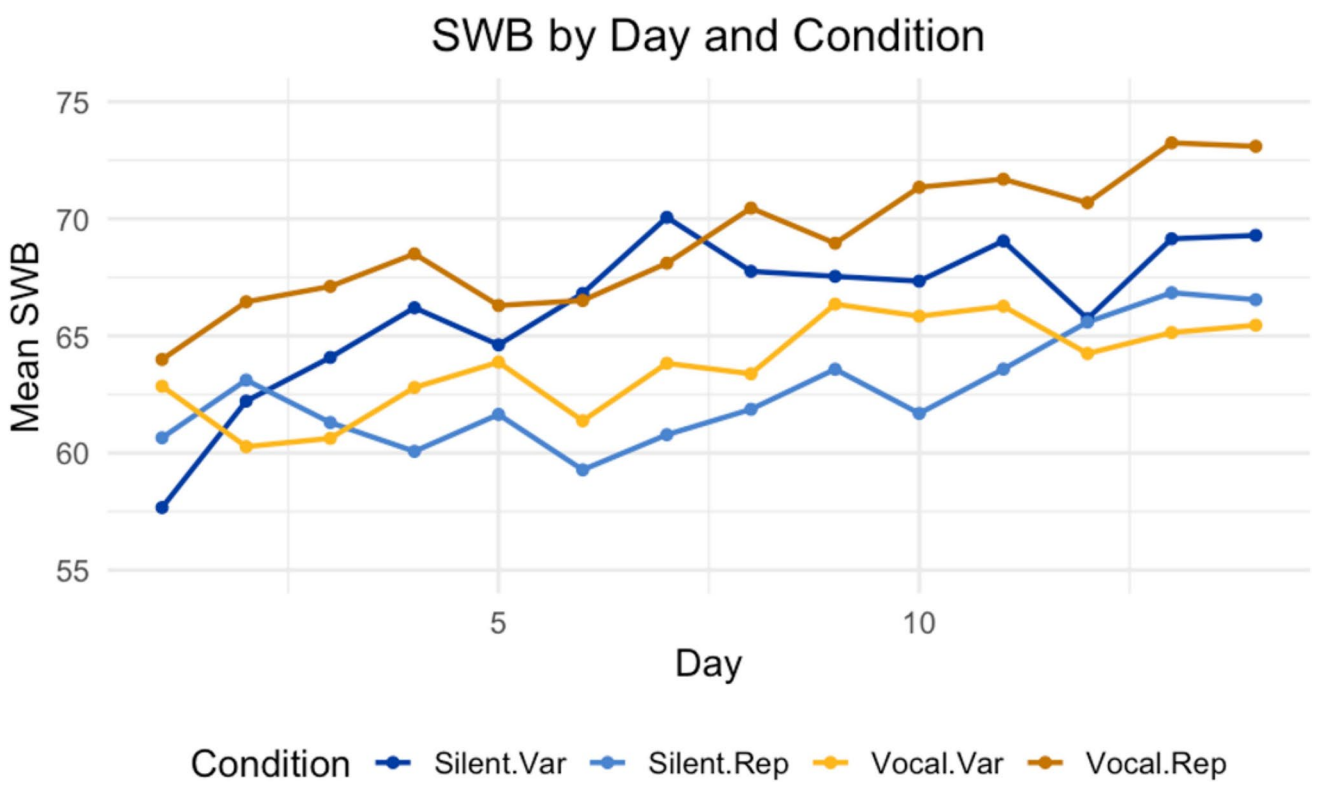
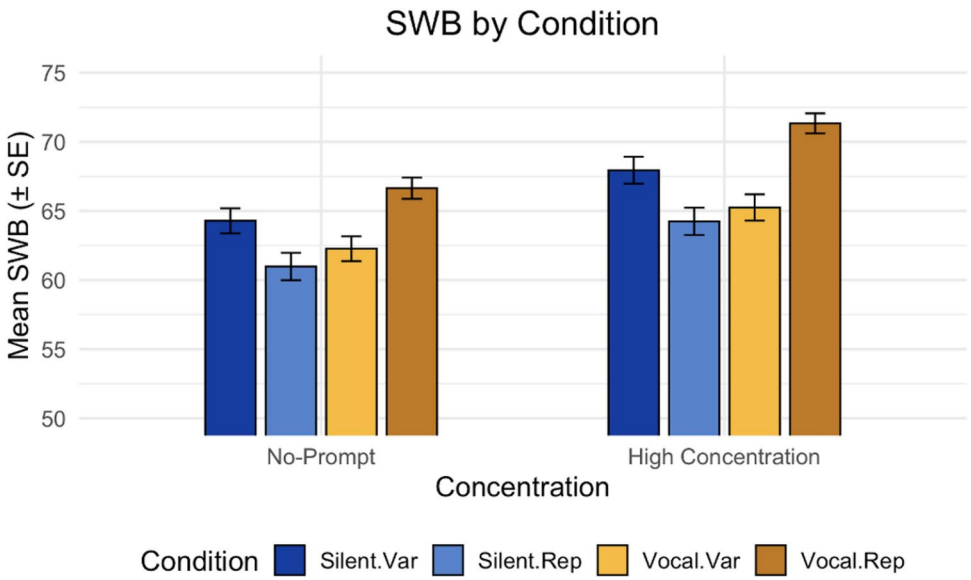


Fig. 4 SWB by day and condition

Fig. 5 SWB by condition



a single sound ($b = 5.03$, $p = 0.023$). No other comparisons were significant.

Also, consistent with hypotheses, during the concentration week, participants in the repeated condition reported significantly lower respiration rates than those in the varied condition ($b = -0.69$, $p = 0.001$; Table S20 and Figure S4). Otherwise, condition did not affect daily heart or respiration rates (Table S21 and Figure S5). Immersion was also significantly higher during the concentration week ($b = 0.20$, $p < 0.001$; Table S22 and Figure S6). Immersion was also higher in the vocal condition than in the silent condition ($b = 0.41$, $p = 0.033$).

These findings suggest that outcomes differed during the concentration week; however, because the concentration

prompt was introduced in Week 2, higher levels of SWB may reflect cumulative effects over time rather than the prompt itself. The linear effect of day on SWB is significant, but the quadratic effect is not ($b = -0.01$, $p = 0.321$; Table S23). The logarithmic effect of day is also significant, indicating that SWB might have spiked early, then leveled off ($b = 2.41$, $p < 0.001$; Table S24). Participants showed a similar rate of increase in SWB over time regardless of whether they were concentrating or not ($b = -0.17$, $p = 0.277$; Table S25). Furthermore, participants did not report more change in SWB in Week 2 compared to Week 1, $t(221) = 1.21$, $p = 0.227$. These results suggest that the apparent effects of concentration may instead reflect cumulative effects of chanting over time.

Mediation Analyses: Rumination, Flow, and Mystical States

Contrary to our hypotheses, none of the proposed mediators significantly mediated the relation between experimental condition and SWB in any condition (Table S26 and Figure S7). However, several associations emerged across conditions. Flow was positively associated with SWB ($b = 1.806$, $p < 0.001$), and rumination was negatively associated with SWB ($b = -0.031$, $p < 0.05$). Mystical states partially mediated the link between experimental condition and heart rate during the concentration week ($ab = -0.666$, $p < 0.05$; Table S27 and Figure S8). Across conditions, mystical states were negatively associated with heart rate ($b = -2.528$, $p < 0.05$). None of the proposed mediators significantly mediated the relation between experimental condition and respiration rate (Table S28 and Figure S9). Likewise, no mediation effects were found for immersion across conditions (Table S29 and Figure S10). Nonetheless, rumination was negatively associated with immersion ($b = -0.005$, $p < 0.05$), and flow was positively associated with immersion ($b = 0.806$, $p < 0.001$). Across conditions and outcomes, the concentration condition was positively associated with mystical states (Tables S26-S29).

Moderation Analyses: Demographics and Personality Traits

Negative emotionality (i.e., neuroticism) significantly moderated the relation between condition and SWB over time, such that participants higher in negative emotionality reported larger increases in SWB ($b = 0.17$, $p = 0.029$; Table S30). No other personality traits significantly moderated the relation between condition and SWB (Tables S31-S34). Gender, adherence, spirituality, and frequency of spiritual practice did not significantly moderate the relation between condition and SWB (Tables S35-S38).

Discussion

Despite growing evidence that both spirituality and positive activities can foster well-being, chanting—an accessible, low-effort, and culturally widespread practice rooted in ritual and contemplative traditions—remains under-researched. This limitation is particularly striking given that many people, including the growing number who identify as SBNR, engage in spiritual practices outside of formal religious contexts. The present study addressed this limitation by experimentally manipulating three core elements of chanting (i.e., vocalization, repetition, and concentration) and assessing their effects on SWB, physiology, and immersion. The study also aimed to clarify the psychological processes through which chanting may influence well-being by testing potential mediators such as rumination, flow, and mystical states.

Consistent with our hypotheses, on average, participants reported increases in SWB over the 14-day study period. This pattern held even after controlling for demographic variables and was observed across both affective (mood) and cognitive (life satisfaction) components of SWB. These results align with prior research suggesting that chanting can increase positive affect and decrease negative affect (Perry et al., 2023; Simpson et al., 2021). Furthermore, because life satisfaction is typically stable over time (Fujita & Diener, 2005), the observed increases over just 14 days suggest that chanting may have potential as a well-being intervention. Although the effect size per day was modest for SWB ($b = 0.67$), the cumulative change over 2 weeks was substantial, providing further evidence that even small daily effects can accumulate into meaningful changes over time (Funder & Ozer, 2019).

Notably, the increase in SWB was not uniform across participants. Substantial between-person variance in baseline SWB was observed, as well as meaningful within-person variability over time. The models fit well; fixed effects alone accounted for 43% of the variance, and the full models—including person-level variability—explained over 80%. These findings suggest that the observed patterns are statistically robust and may be meaningful across individuals with different baseline levels of well-being.

Consistent with our hypotheses, participants in conditions incorporating all three elements (i.e., vocalization, repetition, and concentration) reported the highest levels of SWB. Among the three chanting elements, concentration was associated with the strongest and most consistent differences in SWB and immersion. These results align with previous research showing that concentration and absorption in a task are associated with fewer negative thoughts, increased activation in reward-processing regions in the brain, and stronger feelings of control and intrinsic motivation, which are associated with well-being (Ryan & Deci,

2000; Tabibnia, 2020; Van Der Linden et al., 2021). However, because the concentration prompt was introduced during Week 2, the causes of its effects are ambiguous. Although the results suggest a notable shift during the high-concentration week, the pattern of SWB change across the 2 weeks did not differ significantly, and participants showed similar rates of increase in SWB regardless of concentration condition. These mixed results raise the possibility that the observed benefits may reflect cumulative engagement with chanting over time, rather than the specific effects of concentration. Future research could clarify this issue by manipulating concentration between participants instead of across time.

In contrast to our hypotheses, neither vocalization nor repetition significantly increased SWB. However, mood and immersion were higher in the vocal condition than in the silent condition. Interestingly, the rate of mood improvement over time was smaller in the vocal condition, suggesting a possible trade-off between short-term emotional benefit and long-term hedonic adaptation. These mixed findings may reflect the complexity of the role of vocal engagement in contemplative practices, which could enhance some dimensions of experience (e.g., presence, absorption) while taxing others (e.g., sustained affective benefit).

Similarly, participants who chanted a single sound repeatedly did not report higher levels of well-being than those who chanted varied sounds. However, when participants chanted with concentration, repetition was associated with lower respiration rates. Repetition alone may be insufficient to increase SWB, but when paired with other aspects of chanting, like concentration, it may reflect differences in physiological arousal during chanting.

The present study sought to understand not only whether chanting improves well-being, but how such effects unfold. Of the three hypothesized mediators (i.e., rumination, flow, and mystical states), only one emerged as explanatory, at least for one outcome variable. Specifically, mystical states partially mediated the relation between condition and heart rate during the concentration week. However, none of the proposed mediators explained the relation between condition and SWB. Future research could explore whether deep attentional engagement serves as a catalyst for altered states of consciousness.

Flow, although not a significant mediator, nevertheless played a role. Participants who reported more flow during their chanting sessions also reported higher levels of SWB and immersion, regardless of condition. These associations are consistent with previous research (Csikszentmihalyi & Hunter, 2003; Ilies et al., 2017) and underscore the potential value of subjective engagement in contemplative practice. However, flow did not explain the effects of any specific chanting element. One possible explanation is that the chanting instructions lacked contextual framing, which may be necessary to evoke clear goals and intrinsic motivation.

Rumination, like flow, was also associated with well-being outcomes. Participants who reported less rumination during their chanting sessions also reported higher levels of SWB and immersion, regardless of condition. This finding supports evidence that repetitive practices, such as breathwork, may disrupt negative thought loops by redirecting attention (Feldman et al., 2010). However, the brief duration of daily chanting may have been insufficient to meaningfully reduce rumination, a process that is often deeply entrenched and resistant to change (Watkins & Nolen-Hoeksema, 2014). As with flow, a chanting experience supported by greater knowledge, experience, and contextual framing may be necessary to meaningfully disrupt rumination.

Not all participants experienced SWB benefits equally. Those higher in negative emotionality reported larger increases in SWB over time across the study period. This pattern suggests that individuals who are prone to depression, anxiety, or emotional volatility could benefit more from chanting. This finding also supports the theory that interventions tend to yield stronger effects among those with more room to improve (Layous & Lyubomirsky, 2014). For individuals high in negative emotionality, even modest reductions in distress may represent meaningful psychological shifts.

In contrast, gender, spirituality, frequency of spiritual practice, and the other Big Five traits did not moderate the effects of chanting on SWB. These null findings may at first seem counterintuitive, because spiritual orientation or openness could influence receptivity to, or at least familiarity with, contemplative practices. However, the lack of moderation may also reflect the universal accessibility of chanting. The practice requires no prior experience, no specific belief system, and minimal effort; thus, it may be effective across a wide range of individuals.

Limitations and Future Research

Although this study offers novel insights into the elements of chanting and their effects on SWB, several limitations and opportunities for future research should be acknowledged. The study did not include a no-intervention control condition, as the design was intended to isolate the effects of specific elements of chanting rather than estimate its absolute effect relative to no activity. The study was conducted entirely remotely, which may have introduced variability in participants' environments. Although the remote format removed geographic constraints and supported ecological validity, it also introduced the possibility that external distractions or differences in physical settings could have influenced adherence and outcomes. Additionally, the physiological measures relied on self-reported counts of heart rate

and respiration, which may be subject to measurement error. In particular, asking participants to attend to and count their breathing may itself influence physiological or psychological states, potentially confounding the results. Future research could consider controlled in-lab settings or hybrid designs to balance ecological validity with experimental control.

The duration of the chanting practice—5 min per session—might have been too short to elicit effects. Previous work has shown that longer positive activity interventions are more likely to produce SWB benefits, possibly because participants have more time to convert the activity into a habit (Sin & Lyubomirsky, 2009). Other studies have employed chanting interventions lasting 12 to 20 min (Moss et al., 2012; Niva et al., 2021). Longer chanting sessions may amplify the effects of mediators such as flow or mystical states. Future studies should explore whether dose (i.e., time) moderates SWB, which has been demonstrated in other positive activity interventions (Lyubomirsky & Layous, 2013). In many traditional contexts, chanting is practiced for longer durations and within structured ritual settings, which may further shape its effects.

Although this study focused on rumination, flow, and mystical states, other variables may mediate the effects of chanting on SWB. For example, emotional regulation strategies such as mindfulness could amplify the positive effects of concentration (Bormann et al., 2014). Testing a broader range of mediators may yield a more comprehensive understanding of how chanting influences SWB.

This study controlled for pitch, length, and volume using standardized audio instructions. Although these controls supported consistency, they also limited exploration of how these features could independently influence outcomes. Considering the wide variety of chanting practices worldwide and across traditions (Perry et al., 2021), manipulating pitch, length, and volume could advance scientific understanding of chanting as well as bolster external validity. Future research could experimentally manipulate these features to determine their unique contributions.

Finally, individual differences in motivation, efficacy beliefs, and person-activity fit might have moderated the results. Longitudinal work has shown that people who intentionally participate in a happiness-boosting activity and invest effort into it show greater gains in SWB (Lyubomirsky et al., 2011). Future work should examine the role of trait-level moderators and belief systems to identify for whom chanting may be most effective. Future studies could also examine how social connection moderates the effects of chanting on well-being by comparing group chanting with and without social cues (e.g., behavioral synchrony and shared experience). This work could clarify whether chanting's benefits are amplified through collective experience.

This study is among the first to systematically isolate and test the psychological and physiological effects of chanting, identifying the specific elements—vocalization, repetition, and concentration—that may underlie its benefits. By demonstrating that even brief, daily chanting can foster SWB, particularly when performed with all three elements, this research extends the reach of well-being interventions into a domain that is low-cost, accessible, and culturally resonant across traditions. The results lay the groundwork for understanding why, how, and for whom chanting works. A deeper understanding of how chanting improves well-being not only advances the science of well-being interventions, but also builds a foundation for more targeted, refined spiritual practices designed to engage specific pathways to flourishing.

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Data Availability The data are available on https://osf.io/y5vqk/

Declarations

Ethics Approval This study (IRB: #30572) was approved by the research ethics committee of the University of California, Riverside.

Informed Consent The formal informed consents were obtained from all participants prior to their participation in the study.

Use of Artificial Intelligence ChatGPT-4o was used to correct and enhance some of the sentences in this paper.

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References

Aknin, L. B., Dunn, E. W., Proulx, J., Lok, I., & Norton, M. I. (2020). Does spending money on others promote happiness?: A registered replication report. *Journal of Personality and Social Psychology, 119*(2), e15–e26. https://doi.org/10.1037/pspa0000191

American Psychological Association. (n.d.). Altered state of consciousness. In *APA Dictionary of Psychology*. Retrieved November 15, 2024, from https://dictionary.apa.org/altered-state-of-consciousness

Apel, W. (1958). *Gregorian chant* (Vol. 601). Indiana University Press.

Arend, M. G., & Schäfer, T. (2019). Statistical power in two-level models: A tutorial based on Monte Carlo simulation. *Psychological Methods, 24*(1), 1–19. https://doi.org/10.1037/met0000195

Avram, R., Tison, G. H., Aschbacher, K., Kuhar, P., Vittinghoff, E., Butzner, M., Runge, R., Wu, N., Pletcher, M. J., Marcus, G. M.,

& Olgin, J. (2019). Real-world heart rate norms in the Health eHeart study. *NPJ Digital Medicine, 2*, Article 58. https://doi.org/10.1038/s41746-019-0134-9

Barrett, F. S., Johnson, M. W., & Griffiths, R. R. (2015). Validation of the revised mystical experience questionnaire in experimental sessions with psilocybin. *Journal of Psychopharmacology, 29*(11), 1182–1190. https://doi.org/10.1177/0269881115609019

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Beck, G. L. (2019). Sacred music and Hindu religious experience: From ancient roots to the modern classical tradition. *Religions, 10*(2), Article 85. https://doi.org/10.3390/rel10020085

Bernardi, L., Sleight, P., Bandinelli, G., Cencetti, S., Fattorini, L., Wdowczyc-Szulc, J., & Lagi, A. (2001). Effect of rosary prayer and yoga mantras on autonomic cardiovascular rhythms: Comparative study. *BMJ, 323*(7327), 1446–1449. https://doi.org/10.1136/bmj.323.7327.1446

Bormann, J. E., Oman, D., Walter, K. H., & Johnson, B. D. (2014). Mindful attention increases and mediates psychological outcomes following mantram repetition practice in veterans with posttraumatic stress disorder. *Medical Care, 52*(12 Suppl 5), S13–S18. https://doi.org/10.1097/mlr.0000000000000200

Büssing, A., Michalsen, A., Khalsa, S. B. S., Telles, S., & Sherman, K. J. (2012). Effects of yoga on mental and physical health: A short summary of reviews. *Evidence-Based Complementary and Alternative Medicine, 2012*, 165410. https://doi.org/10.1155/2012/165410

Canty, A., & Ripley, B. (2022). *Boot: Bootstrap R (S-Plus) functions* (Version 1.3–28.1) [R package]. Comprehensive R Archive Network (CRAN). https://cran.r-project.org/web/packages/boot/boot.pdf. Accessed 7 March 2025

Carr, A., Cullen, K., Keeney, C., Canning, C., Mooney, O., Chinseallaigh, E., & O'Dowd, A. (2021). Effectiveness of positive psychology interventions: A systematic review and meta-analysis. *The Journal of Positive Psychology, 16*(6), 749–769. https://doi.org/10.1080/17439760.2020.1818807

Casey, M. (2005). *An unexciting life: Reflections on Benedictine spirituality*. St Bede's Publications.

Collins, A. L., Sarkisian, N., & Winner, E. (2009). Flow and happiness in later life: An investigation into the role of daily and weekly flow experiences. *Journal of Happiness Studies, 10*, 703–719. https://doi.org/10.1007/s10902-008-9116-3

Csikszentmihalyi, M., & Hunter, J. (2003). Happiness in everyday life: The uses of experience sampling. *Journal of Happiness Studies, 4*, 185–199. https://doi.org/10.1023/A:1024409732742

Csikszentmihalyi, M., & Larson, R. (2014). *Flow and the foundations of positive psychology* (pp. 35–54). Springer. https://doi.org/10.1007/978-94-017-9088-8

Diener, E. (1984). Subjective well-being. *Psychological Bulletin, 95*(3), 542–575. https://doi.org/10.1037/0033-2909.95.3.542

Diener, E., & Emmons, R. A. (1984). The independence of positive and negative affect. *Journal of Personality and Social Psychology, 47*(5), 1105–1117. https://doi.org/10.1037/0022-3514.47.5.1105

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment, 49*, 71–75. https://doi.org/10.1207/s15327752jpa4901_13

Feldman, G., Greeson, J., & Senville, J. (2010). Differential effects of mindful breathing, progressive muscle relaxation, and loving-kindness meditation on decentering and negative reactions to repetitive thoughts. *Behaviour Research and Therapy, 48*(10), 1002–1011. https://doi.org/10.1016/j.brat.2010.06.006

Fraley, R. C., & Vazire, S. (2014). The N-pact factor: Evaluating the quality of empirical journals with respect to sample size and statistical power. *PLoS ONE, 9*(10), Article e109019. https://doi.org/10.1371/journal.pone.0109019

Fujita, F., & Diener, E. (2005). Life satisfaction set point: Stability and change. *Journal of Personality and Social Psychology, 88*(1), 158–164. https://doi.org/10.1037/0022-3514.88.1.158

Fullagar, C. J., & Kelloway, E. K. (2009). Flow at work: An experience sampling approach. *Journal of Occupational and Organizational Psychology, 82*(3), 595–615. https://doi.org/10.1348/096317908X357903

Funder, D. C., & Ozer, D. J. (2019). Evaluating effect size in psychological research: Sense and nonsense. *Advances in Methods and Practices in Psychological Science, 2*(2), 156–168. https://doi.org/10.1177/2515245919847202

Griffiths, R. R., Hurwitz, E. S., Davis, A. K., Johnson, M. W., & Jesse, R. (2019). Survey of subjective "God encounter experiences": Comparisons among naturally occurring experiences and those occasioned by the classic psychedelics psilocybin, LSD, ayahuasca, or DMT. *PLoS ONE, 14*(4), Article e0214377. https://doi.org/10.1371/journal.pone.0214377

Hartley, J. (2018). Respiratory rate 2: Anatomy and physiology of breathing. *Nursing times, 114*(6), 43–44.

Harvey, P. (2012). *An introduction to Buddhism: Teachings, history and practices*. Cambridge University Press.

Hobson, N. M., Schroeder, J., Risen, J. L., Xygalatas, D., & Inzlicht, M. (2018). The psychology of rituals: An integrative review and process-based framework. *Personality and Social Psychology Review, 22*(3), 260–284. https://doi.org/10.1177/1088868317734944

Ilies, R., Wagner, D., Wilson, K., Ceja, L., Johnson, M., DeRue, S., & Ilgen, D. (2017). Flow at work and basic psychological needs: Effects on well-being. *Applied Psychology, 66*(1), 3–24. https://doi.org/10.1111/apps.12075

Jacobs Bao, K. (2012). The course of well-being in romantic relationships: Predicting positive affect in dating participants. *Psychology, 3*(12A), 1091–1099. https://doi.org/10.4236/psych.2012.312A161

Kim-Prieto, C., & Miller, L. (2018). Intersection of religion and subjective well-being. In E. Diener, S. Oishi, & L. Tay (Eds.), *Handbook of well-being* (pp. 1–9). DEF Publishers.

Kirkegaard Thomsen, D. (2006). The association between rumination and negative affect: A review. *Cognition and Emotion, 20*(8), 1216–1235. https://doi.org/10.1080/02699930500473533

Krygier, J. R., Heathers, J. A., Shahrestani, S., Abbott, M., Gross, J. J., & Kemp, A. H. (2013). Mindfulness meditation, well-being, and heart rate variability: A preliminary investigation into the impact of intensive Vipassana meditation. *International Journal of Psychophysiology, 89*(3), 305–313. https://doi.org/10.1016/j.ijpsycho.2013.06.017

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. (2017). lmerTest package: Tests in linear mixed effects models. *Journal of Statistical Software, 82*, 1–26. https://doi.org/10.18637/jss.v082.i13

Layous, K., & Lyubomirsky, S. (2014). The how, why, what, when, and who of happiness. In J. Gruber & J. T. Moskowitz (Eds.), *Positive emotion* (pp. 472–495). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199926725.003.0025

Lenth, R. V. (2025). *emmeans*: *Estimated marginal means, aka least-squares means* (Version 1.10.7) [R package]. R Foundation for Statistical Computing. https://CRAN.R-project.org/package=emmeans. Accessed 7 March 2025

Lüdecke, D., Ben-Shachar, M. S., Patil, I., Waggoner, P., & Makowski, D. (2021). Performance: An R package for assessment, comparison and testing of statistical models. *Journal of Open Source Software, 6*(60), Article 3139. https://doi.org/10.21105/joss.03139

Lynch, J., Prihodova, L., Dunne, P. J., Carroll, A., Walsh, C., McMahon, G., & White, B. (2018). Mantra meditation for mental health in the general population: A systematic review. *European Journal*

of Integrative Medicine, 23, 101–108. https://doi.org/10.1016/j.eujim.2018.09.010

Lyubomirsky, S., & Layous, K. (2013). How do simple positive activities increase well-being? *Current Directions in Psychological Science, 22*(1), 57–62. https://doi.org/10.1177/0963721412469809

Lyubomirsky, S., King, L., & Diener, E. (2005). The benefits of frequent positive affect: Does happiness lead to success? *Psychological Bulletin, 131*(6), 803–855. https://doi.org/10.1037/0033-2909.131.6.803

Lyubomirsky, S., Dickerhoof, R., Boehm, J. K., & Sheldon, K. M. (2011). Becoming happier takes both a will and a proper way: An experimental longitudinal intervention to boost well-being. *Emotion, 11*(2), 391–402. https://doi.org/10.1037/a0022575

MacDonald, R., Kreutz, G., & Mitchell, L. (Eds.). (2013). *Music, health, and wellbeing*. Oxford University Press.

Marchetti, I., Mor, N., Chiorri, C., & Koster, E. H. W. (2018). The Brief State Rumination Inventory (BSRI): Validation and psychometric evaluation. *Cognitive Therapy and Research, 42*, 447–460. https://doi.org/10.1007/s10608-018-9901-1

Mason, J. W., Ramseth, D. J., Chanter, D. O., Moon, T. E., Goodman, D. B., & Mendzelevski, B. (2007). Electrocardiographic reference ranges derived from 79,743 ambulatory subjects. *Journal of Electrocardiology, 40*(3), 228–234. https://doi.org/10.1016/j.jelectrocard.2006.09.003

Millière, R., Carhart-Harris, R. L., Roseman, L., Trautwein, F. M., & Berkovich-Ohana, A. (2018). Psychedelics, meditation, and self-consciousness. *Frontiers in Psychology, 9*, Article 1475. https://doi.org/10.3389/fpsyg.2018.01475

Moss, A. S., Wintering, N., Roggenkamp, H., Khalsa, D. S., Waldman, M. R., Monti, D., & Newberg, A. B. (2012). Effects of an 8-week meditation program on mood and anxiety in patients with memory loss. *The Journal of Alternative and Complementary Medicine, 18*(1), 48–53. https://doi.org/10.1089/acm.2011.0051

Nakamura, J., & Csikszentmihalyi, M. (2014). The concept of flow. *Flow and the foundations of positive psychology: The collected works of Mihaly Csikszentmihalyi* (pp. 239–263). Springer. https://doi.org/10.1007/978-94-017-9088-8_16

Natarajan, A., Su, H. W., Heneghan, C., Blunt, L., O'Connor, C., & Niehaus, L. (2021). Measurement of respiratory rate using wearable devices and applications to COVID-19 detection. *NPJ Digital Medicine, 4*, Article 136. https://doi.org/10.1038/s41746-021-00493-6

Niva, W. J., Sekar, L., Manikandan, A., MaheshKumar, K., Ganesan, T., Shriraam, V., Silambanan, S., & Padmavathi, R. (2021). Mahamantra chanting as an effective intervention for stress reduction among nursing professionals—A randomized controlled study. *Advances in Integrative Medicine, 8*(1), 27–32. https://doi.org/10.1016/j.aimed.2020.05.007

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science, 3*(5), 400–424. https://doi.org/10.1111/j.1745-6924.2008.00088.x

Norsworthy, C., Dimmock, J. A., Miller, D. J., Krause, A., & Jackson, B. (2023). Psychological flow scale (PFS): Development and preliminary validation of a new flow instrument that measures the core experience of flow to reflect recent conceptual advancements. *International Journal of Applied Positive Psychology, 8*(2), 309–337. https://doi.org/10.1007/s41042-023-00092-8

Ottaviani, C., Thayer, J. F., Verkuil, B., Lonigro, A., Medea, B., Couyoumdjian, A., & Brosschot, J. F. (2016). Physiological concomitants of perseverative cognition: A systematic review and meta-analysis. *Psychological Bulletin, 142*(3), 231–259. https://doi.org/10.1037/bul0000036

Peifer, C., & Tan, J. (2021). The psychophysiology of flow experience. In C. Peifer & S. Engeser (Eds.), *Advances in flow research* (2nd ed., pp. 191–230). Springer Nature Switzerland AG. https://doi.org/10.1007/978-3-030-53468-4_8

Perry, G., Polito, V., & Thompson, W. F. (2021). Rhythmic chanting and mystical states across traditions. *Brain Sciences, 11*(1), Article 101. https://doi.org/10.3390/brainsci11010101

Perry, G., Polito, V., Sankaran, N., & Thompson, W. F. (2022). How chanting relates to cognitive function, altered states and quality of life. *Brain Sciences, 12*(11), Article 1456. https://doi.org/10.3390/brainsci12111456

Perry, G., Polito, V., & Thompson, W. F. (2023). Exploring the physiological and psychological effects of group chanting in Australia: Reduced stress, cortisol and enhanced social connection. *Journal of Religion and Health, 1–23.* https://doi.org/10.1007/s10943-023-01967-5

Pew Research Center. (2023). *Who are 'spiritual but not religious' Americans?* Pew Research Center. https://www.pewresearch.org/religion/2023/12/07/who-are-spiritual-but-not-religious-americans/. Accessed 7 March 2025

R Core Team. (2023). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.R-project.org/. Accessed 7 March 2025

Rogatko, T. P. (2009). The influence of flow on positive affect in college students. *Journal of Happiness Studies, 10*, 133–148. https://doi.org/10.1007/s10902-007-9069-y

Rosas, F. E., Mediano, P. A. M., Timmermann, C., Luppi, A. I., Candia-Rivera, D., Abbasi-Asl, R., Gazzaley, A., Kringelbach, M. L., Muthukumaraswamy, S., Bor, D., Garfinkel, S., & Carhart-Harris, R. L. (2023). The entropic heart: Tracking the psychedelic state via heart rate dynamics. *bioRxiv*. https://doi.org/10.1101/2023.11.07.566008

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Sargeant, W. (Trans.). (2009). *The Bhagavad Gita* (C. K. Chapple, Ed.). SUNY Press

Simpson, F. M., Perry, G., & Thompson, W. F. (2021). Assessing vocal chanting as an online psychosocial intervention. *Frontiers in Psychology, 12*, Article 647632. https://doi.org/10.3389/fpsyg.2021.647632

Sin, N. L., & Lyubomirsky, S. (2009). Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-analysis. *Journal of Clinical Psychology, 65*(5), 467–487. https://doi.org/10.1002/jclp.20593

Soto, C. J., & John, O. P. (2017). Short and extra-short forms of the Big Five Inventory–2: The BFI-2-S and BFI-2-XS. *Journal of Research in Personality, 68*, 69–81. https://doi.org/10.1016/j.jrp.2017.02.004

Spilka, B. (2005). Religious practice, ritual, and prayer. In R. F. Paloutzian & C. L. Park (Eds.), *Handbook of the psychology of religion and spirituality* (pp. 365–377). The Guilford Press.

Strickland, J. C., Garcia-Romeu, A., & Johnson, M. W. (2024). The Mystical Experience Questionnaire 4-item and Challenging Experience Questionnaire 7-item. *Psychedelic Medicine, 2*(1), 33–43. https://doi.org/10.1089/psymed.2023.0046

Tabibnia, G. (2020). An affective neuroscience model of boosting resilience in adults. *Neuroscience and Biobehavioral Reviews, 115*, 321–350. https://doi.org/10.1016/j.neubiorev.2020.05.005

Tingley, D., Yamamoto, T., Hirose, K., Keele, L., & Imai, K. (2014). Mediation: R package for causal mediation analysis. *Journal of Statistical Software, 59*, 1–38. https://doi.org/10.18637/jss.v059.i05

Trehub, S. E., Becker, J., & Morley, I. (2015). Cross-cultural perspectives on music and musicality. *Philosophical Transactions of the Royal Society b: Biological Sciences, 370*(1664), Article 20140096. https://doi.org/10.1098/rstb.2014.0096

Tyagi, A., & Cohen, M. (2013). Oxygen consumption changes with yoga practices: A systematic review. *Journal of Evidence-Based*

Complementary & Alternative Medicine, 18(4), 290–308. https://doi.org/10.1177/2156587213492770

Van Cappellen, P., Zhang, R., & Fredrickson, B. L. (2023). The scientific study of positive emotions and religion/spirituality. In E. B. Davis, E. L. Worthington, & S. A. Schnitker (Eds.), *Handbook of positive psychology, religion, and spirituality* (pp. 315–328). Springer International Publishing. https://doi.org/10.1007/978-3-031-10274-5_20

Van Der Linden, D., Tops, M., & Bakker, A. B. (2021). Go with the flow: A neuroscientific view on being fully engaged. *European Journal of Neuroscience, 53*(4), 947–963. https://doi.org/10.1111/ejn.15014

Walsh, L. C., Regan, A., Twenge, J. M., & Lyubomirsky, S. (2023). What is the optimal way to give thanks? Comparing the effects of gratitude expressed privately, one-to-one via text, or publicly on social media. *Affective Science, 4*(1), 82–91. https://doi.org/10.1007/s42761-022-00150-5

Watkins, E. R., & Nolen-Hoeksema, S. (2014). A habit-goal framework of depressive rumination. *Journal of Abnormal Psychology, 123*(1), 24–34. https://doi.org/10.1037/a0035540

Watkins, E. R., & Roberts, H. (2020). Reflecting on rumination: Consequences, causes, mechanisms and treatment of rumination. *Behaviour Research and Therapy, 127*, Article 103573. https://doi.org/10.1016/j.brat.2020.103573

Wood, C. (2017). Ritual well-being: Toward a social signaling model of religion and mental health. *Religion, Brain & Behavior, 7*(3), 223–243. https://doi.org/10.1080/2153599X.2016.1156556

Wulff, D. M. (2014). Mystical experiences. In E. Cardeña, S. J. Lynn, & S. Krippner (Eds.), *Varieties of anomalous experience: Examining the scientific evidence* (2nd ed., pp. 369–408). American Psychological Association. https://doi.org/10.1037/14258-013

Yaden, D. B., Haidt, J., Hood, R. W., Jr., Vago, D. R., & Newberg, A. B. (2017). The varieties of self-transcendent experience. *Review of General Psychology, 21*(2), 143–160. https://doi.org/10.1037/gpr0000102

Yaden, D. B., Batz-Barbarich, C. L., Ng, V., Vaziri, H., Gladstone, J. N., Pawelski, J. O., & Tay, L. (2022). A meta-analysis of religion/spirituality and life satisfaction. *Journal of Happiness Studies, 23*(8), 4147–4163. https://doi.org/10.1007/s10902-022-00558-7