# Stressor reflections, sleep, and psychological well-being: A pre-registered experimental test of self-distanced versus self-immersed reflections

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## Abstract

**Objective**: Evidence supports the effectiveness of cuing people to analyse negative autobiographical experiences from self-distanced rather than self-immersed perspectives. However, the evidence on which this expectation resides is limited largely to static snapshots of mean levels of cognitive and emotional factors.

**Methods**: Via a pre-registered, randomised controlled trial (N = 257), we examined the differential effectiveness of self-distanced relative to self-immersed reflections on mean levels and within-person variability of sleep duration and quality as well as psychological well-being over a 5-day working week.

**Results**: Except for sleep quality, we found that reflecting from a psychologically distanced perspective, overall, was no more effective for mean levels and within-person variability of sleep duration, well-being, and stress-related factors than when the current self is fully immersed in the experiential reality of the event.

**Conclusions**: We consider several substantive and methodological considerations (e.g., dosage, salience of stressor event) that require interrogation in future research via experimental and longitudinal observational methods.


Keywords: construal level theory; emotion regulation; heterogenous variance model; intra-individual variability; perspective taking; vantage point

# Stressor reflections, sleep, and psychological well-being: A pre-registered experimental test of self-distanced versus self-immersed reflections

Reflecting on our experiences is one of the most useful strategies by which individuals and collectives can augment learning and development efforts for optimising health, well-being, and functioning (e.g., Ellis et al., 2014; Guo, 2022; Lines et al., 2021). As a meta-cognitive strategy, which essentially means 'thinking about thinking', reflection involves deliberately and consciously unpacking the ambiguities of real-world or simulated experiences for knowledge of strengths and weaknesses in how one behaved, and lessons learned for improving future behaviour (for a review of definitions, see Marshall, 2019). Implementing reflections in practice are relatively inexpensive; as a minimum, one requires paper and pencil to document their learnings, though the meta-cognitive process can be augmented via technology such as tablets to document information digitally or audio-visual footage to bolster recall of the target experience. Reflective practice is a core among continuing professional development approaches within health, military, educational, and coaching professions (Chan & Lee, 2021; Da Silva et al., 2020; Guo, 2022; Sayer et al., 2015; Ziebart & MacDermid, 2019). From a clinical standpoint, psychotherapeutic interventions often utilise various metacognitive strategies whereby therapists work collaboratively with their patients to reflect on their cognitions and emotional states within the context of stressor or traumatic events (Moritz et al., 2019). Reflections can also be applied proactively to foster resilience readiness or resilient outcomes among apparently healthy populations (Crane et al., 2019a; Falon et al., 2021). Suffice to say, reflections represent a pragmatic, inexpensive, and widely utilised self-regulatory strategy by which people can make the most of the experiences in their lives.

As with many self-regulatory strategies designed to optimise human health and functioning, it is erroneous to presume that all forms of self-reflection are adaptive and

therefore optimise learning and developmental success. Psychological distancing, which reflects the degree to which one's egocentric reasoning of a target event is entrenched within or removed from the reality of that experience (Ayduk & Kross, 2010; Kross & Ayduk, 2011), represents one important consideration for distinguishing adaptive from maladaptive forms of self-reflection. Inspired by seminal work in developmental psychology (e.g., delay of gratification; Mischel et al., 1989) and reflective techniques often packaged within cognitive therapies (e.g., Beck's cognitive therapy; Beck & Haigh, 2014) as well as Buddhist traditions adapted to Western contexts (e.g., decentering within mindfulness practice; Safran & Segal, 1990), researchers have empirically demonstrated that reflecting on and analysing negative experiences from a self-distanced standpoint ('stepping' back to review one's experience including thoughts and feelings as a neutral observer or 'big picture' standpoint), relative to one that promotes a self-immersed perspective (reliving the experience firsthand as one originally experienced it) is adaptive for health and well-being (for a narrative review, see Kross & Ayduk, 2017). Self-distanced reflections exert their influence primarily via reconstruing and optimised emotional reactivity (Kross & Ayduk, 2017). Briefly, self-distanced reflections promote reconstruing of the target experience in ways that maximise introspection, insight, and closure (see also, Liu et al., 2019) rather than recounting the episodic and negative emotionally salient features of it. Reconstruing the autobiographical experience rather than simply recounting it, in turn, minimises emotional reactivity (e.g., escalated negative affect and physiological stress), promotes meaning change, and buffers against repetitive, prolonged, and recurrent negative thoughts characteristic of rumination. Thus, there exists a compelling body of evidence to support the adaptiveness of strategies that cue people to analyse negative autobiographical experiences from self-distanced rather than self-immersed perspectives.

Narrative reviews support the usefulness of self-distanced reflections (for psychological distance and abstraction broadly, see Soderberg et al., 2015), yet they offer little guidance regarding how much they affect important cognitive, affective, and behavioural outcomes. An important question for the science and practice of self-distanced reflection strategies is not whether they are adaptive, but rather by how much they effect change or development and under what circumstances they work best. We addressed this knowledge gap via a pre-registered systematic review and meta-analysis to estimate the differential effectiveness of self-distanced reflections, relative to self-immersed reflections, within the context of past experienced stressor events among apparently healthy adults (Murdoch et al., in press). Interested readers are referred elsewhere for a broader meta-analytic review of psychological distancing relative to all types of comparators, yet focused specifically on the outcome of emotional experience (Moran & Eyal, 2022). Our analysis of 25 experiments ($N$ = 2,397, 68 effects) revealed a small-to-moderate advantage of self-distanced reflections ($g$ = .19, $SE$ = .07, 95% CI [.05, .33]) and were most effective when they targeted a stressor experience that emphasised one's emotional state or the emotional significance of the event (e.g., overwhelming feelings of sadness, anger, hostility, depression). This advantage can be considered practically meaningful because the application of self-distanced reflections demands few resources and costs.

We also identified several areas for improvement in future research that provide inspiration for the current study. First, with few exceptions (Dorfman et al., 2021; Grossmann et al., 2021), the reliance on static snapshots of mean levels of outcome variables means there is an absence of evidence on the influence of self-distanced reflections on temporal changes in intra-individual variability in outcomes. This omission is important because many indicators of health, well-being, and functioning vary temporally and situationally (e.g., Braem & Egner, 2018; Dalal et al., 2020; Schiweck et al., 2019; Wirth et al., 2022) making

knowledge of determinants of such intra-individual variability alongside their mean changes potentially meaningful for affecting change positively. For example, two people may be relatively similar in their overall mean level of indicators of health, well-being, and functioning over a 7-day period, yet differ markedly regarding the degree to which they fluctuate around their personal average (e.g., low versus high variability). In so doing, moderate-to-high levels of overall sleep duration over a 7-day period, for example, may be masked by one or two nights where individuals accrued a high level of sleep, perhaps to compensate for poor sleep the previous couple of nights. Broadly speaking, high variability in many cognitive, emotional, and biological factors places people at risk for various health and behavioural issues (Bei et al., 2016; Houben et al., 2015; Segerstrom et al., 2017). Of course, substantive and contextual considerations are important for interpretations regarding the mal/adaptiveness of intra-individual variability, because high variability might be indicative of maladaptive or adaptive functioning depending on the outcome and context in which it is assessed. For example, low intra-individual variability might reflect resistance to situational stressors (e.g., sleep, well-being), or it might indicate poor self-regulatory processes where situational factors require people adapt according to varying contextual demands (e.g., emotional responses). Conceptually, intra-individual variability also encompasses information on short-term mal/adaptive processes, regulatory mechanisms, and in/vulnerability of systems that can generate new or rich insights for theory development or refinement (Lang et al., 2021; Lester et al., 2019; McNeish, 2020).

Second, most lab or field experiments targeted affective (~62%) or cognitive outcomes (~29%), with few studies assessing the effectiveness of self-distanced reflections on behavioural outcomes (e.g., Furman et al., 2020; Gainsburg et al., 2022). Knowledge of the internal capacities, states, or processes affected by self-distanced reflections is important, yet offers limited insight into the adaptiveness of this self-regulatory strategy for actions in

the real world. Aside from identifying psychologically-informed solutions to real-world problems, the focus on behaviour can underpin scholars' efforts towards developing theory that is practically meaningful (Berkman & Wilson, 2021). Finally, 11 experiments were assessed 'some concern' and 14 experiments as high risk of bias, due primarily to poor statistical power; manipulation checks of experimental manipulations in 14 of the 25 experiments, yet excluded no participants who deviated from their intended experimental manipulation; and relied on undergraduate students (24 of 25 experiments). Thus, there remains a need for research that alleviates such methodological concerns to provide insight into the robustness of the adaptiveness of self-distanced reflections.

We address these gaps in the evidence base by experimentally testing the differential effectiveness of self-distanced versus self-immersed reflections on an autobiographical stressor experience within a single session on mean levels and intra-individual variability in self-reported sleep and psychological well-being during the subsequent working week. Sleep is a worthy focus because of its well-established importance for health (e.g., physical, psychological) and functioning (e.g., educational, workplace) (Itani et al., 2017; Jike et al., 2018) and, perhaps most importantly, all-cause mortality (García-Perdomo et al., 2019). This importance for health and functioning includes intra-individual variability in sleep, even after accounting for habitual sleep patterns for duration, efficiency, and timing (Bei et al., 2016). Sleep health – which encompasses both quantity (at least 7 hours per night, Consensus Conference Panel, 2015) and quality of sleep – represents a truly global problem (Simonelli et al., 2018). These same arguments extend to psychological well-being – both magnitude and intra-individual variability dimensions – as a key marker of health for which psychological scientists are acutely aware (Ngamaba et al., 2017; Oishi & Westgate, 2021).

Stress is a well-known antecedent to poor sleep functioning and well-being (Gardani et al., 2021; Kim & Dimsdale, 2007; Van Reeth et al., 2000). Broadly, stress influences

biological (e.g., neuroendocrine and autonomic processes) and behavioural (e.g., habitual and non-habitual actions) health systems, typically in a bidirectional fashion (O'Conner et al., 2021). Regarding stress and sleep, for example, stressor exposure triggers impairments to subsequent sleep episodes (e.g., quality, duration), which in turn impairs daily functioning following a poor night of sleep (Prather, 2019). From a practical standpoint, stabilising sleep-wake cycles (intra-individual variability) is one of the primary mechanisms by which cognitive therapies for sleep issues exert their influence (Schwartz & Carney, 2012). As one of the primary cognitive representations of stress (Verkuil et al., 2010), it is likely that stress has deleterious effects on sleep and well-being via ruminative thinking on past stressful events and worry about feared future events (Clancy et al., 2020; McCarrick et al., 2021). Thus, strategies such as self-distanced reflections which help people minimise ruminative thought and worry, prompt individuals to engage with stressor experiences adaptively, and/or self-regulate their emotions adaptively should alleviate the potentially maladaptive outcomes of such experiences (Kross & Ayduk, 2017; Orvell et al., 2022; Palmer & Alfano, 2017). For these reasons, interventions designed to minimise within-person variability in sleep and well-being over time offer great promise alongside interventions that optimise their overall magnitude. Against this backdrop, we expected people who reflect on a recent stressor experience from a self-distanced perspective to report higher mean levels and lower variability in (a) sleep duration and quality, and (b) well-being across a 5-day period, when compared with people who take a self-immersed perspective to their reflections.

## Methods

### Transparency and Openness

All data, analysis code, and research materials are publicly available via our Open Science Framework project page (https://osf.io/ue9jm/). We pre-registered the design and analysis plan for this experiment on 21st August 2021 (https://osf.io/jyf69). Deviations from

our registered protocol are reported below in the section 'Deviations from registered protocol'.

**Participants and Sample Size Justifications**

Our target sample size of 250 people sought a balance between conservative expectations for effect size and funds available for this project. The concept of statistical power for multilevel models involving several fixed and random effects is complex, particularly in the absence of prior research to guide judgements regarding 'reliable' estimates of population effects (Arend & Schäfer, 2019; Lane & Hennes, 2018; Lang et al., 2019). Power simulations inspired by work on consensus emergence modelling (Lang et al., 2019) indicated that 250 participants who complete 5 daily assessments of sleep metrics is sufficiently sensitive ($\geq$80% power) to detect small-to-moderate effects for the main effect of the experimental condition (on overage, 15-20% differences in residual variances), and moderate effects for the interaction between experimental condition and curiosity or stress mindsets (on overage, 20-30% differences in residual variances). The code and outputs of these simulations are available on the Open Science Framework (OSF) project page (https://osf.io/ue9jm/). We recruited participants online using the panel platform Prolific Academic (app.prolific.co). All registered members on Prolific who were residents of the United Kingdom were eligible to take part to maximise consistency in the time zone for typical sleep schedules. We excluded individuals who worked rotating/night shifts, had sleep disorders (e.g., sleep apnoea), or took medication that could affect their sleep (e.g., beta-blockers); or who completed only 1 of the 5 daily assessments because we were interested primarily in within-person variability in the primary outcomes. We restricted the temporal focus of the current study to working weekdays (i.e., Monday-Friday) because determinants of sleep tend to differ considerably between weekdays and weekends (Paine & Gander, 2016). All participants provided informed consent to take part in this research.

## Research Design

We implemented a longitudinal experimental design in which participants were randomly assigned 1:1 using the Qualtrics randomiser function to reflect on a stressful event experience over the past two weeks via a self-immersed or self-distanced perspective (Sunday) [between-subjects factor], and subsequently completed daily measures of sleep metrics and psychological well-being for the following 5-days (Monday-Friday) [within-subjects factors]. We implemented a single session of reflection for the experimental manipulation for consistency with previous work on self-distanced reflections. A visual depiction of the study design is provided in Figure S1; the baseline and daily surveys are available on the OSF project page (https://osf.io/ue9jm/). The study design and online platform enabled us to apply triple-blinding where the nature of the experiment is concealed from participants (they were unaware of how many other self-reflection treatments were involved in the study), the research team (allocation concealment), and the data analyst (experimental assignment was revealed once all data had been analysed).

## Experimental Conditions

We had participants reflect on a recent stressor in this experiment, which we defined as events which typically pose heightened vulnerability to maladaptive outcomes, depending on their intensity and frequency as well as emotional significance (Luhmann et al., 2021). Defined in this way, stressor events contain situational cues that individuals cognitively process in relation to salient personal (e.g., traits, resources) or social (e.g., support) factors that they might deploy to minimise or mitigate their effects on one's functioning. Thus, we emphasised these elements in our experimental instructions within each condition.

Conceptually, the substantive nature of our reflection task is informed by the idea that systematic reflections of experienced stressor experiences can strengthen one's insight about their coping capacities that underpin their readiness to demonstrate resilience to future

stressor events (Crane et al., 2019a). There exists preliminary experimental support for the beneficial nature of systematic stressor reflections (Falon et al., 2021; Crane et al., 2019b). We developed a shortened version of Crane and colleagues' established reflection protocol to prompt or guide reflections towards key elements that might enhance their self-awareness and self-understanding of coping capacities and temporal dynamics of their self-regulatory experiences with stressor events. In so doing, our manipulation utilised a combination of spatial (i.e., standing on the sidelines watching yourself experience the event), objective (i.e., third-person perspective like a sport coach watching their athletes), and temporal forms (i.e., how might they cope differently next time they experienced a stressful event) of psychological distancing to prompt people to mentally represent events and objects in higher-level, abstract ways, yet excluded a hypothetical component (e.g., how might you feel about how well you coped if the event was imagined or hypothetical rather than real). Interested readers are referred elsewhere for overviews of the different types of psychological distancing tactics (Powers & LaBar, 2019; Trope & Liberman, 2010).

Participants in the self-immersed condition received the following contextual information:

> *We'd like you to spend 5 minutes reflecting on and writing down these reflections of the most stressful event or situation you experienced over the past two weeks. Think of this situation as something that really challenged you psychologically, emotionally, and/or behaviourally to ensure you weren't negatively affected. There are a series of questions that we'd like you to consider as part of your reflections. To optimise your recall, we'd like for you to visualise and reflect on this event from a first-person perspective, that is, trying your best to 'relive' the experience as it occurred for you. A useful analogy is that of someone being interviewed by a reporter to recall their first-hand experience of some exciting event as they experienced it.*

Subsequently, participants responded to the following open-ended questions:

1. Briefly describe the nature of the stressor you see yourself experiencing (e.g., who was involved, where and when did it occur).

2. Looking back on this experience, how well did you respond to this stressor?
3. What did you do to cope with the situation? Think of the things you can hear yourself say or do that helped or hindered you in that situation.
4. What could you do differently next time you experienced a stressful event to cope well with that situation?

Participants in the self-distanced condition first completed a question in which they were asked to tell us their preferred name – the name by which their family and friends call them (e.g., first name, nickname). Doing so allowed us to automatically pipe their preferred name into the questions for their self-reflection, which they completed after they received the following contextual information.

> *We'd like you to spend 5 minutes reflecting on and writing down these reflections of the most stressful event or situation you experienced over the past two weeks. Think of this situation as something that really challenged you psychologically, emotionally, and/or behaviourally to ensure you weren't negatively affected. There are a series of questions that we'd like you to consider as part of your reflections. To optimise your recall, we'd like for you to visualise and reflect on this event from a third-person perspective, that is, someone who is observing someone else experience the event. A useful analogy is that of sport coaches watching their athletes complete a drill, where in this scenario you're standing on the sidelines watching yourself experience the event.*

Subsequently, participants responded to the following open-ended questions:

1. Briefly describe the nature of the stressor you see [***preferred name inserted***] experiencing (e.g., who was involved, where and when did it occur).
2. Looking back on this experience, how well did [***preferred name inserted***] respond to this stressor?
3. What did [***preferred name inserted***] do to cope with the situation? Think of the things you can hear them say or do that helped or hindered them in that situation.
4. What could [***preferred name inserted***] do differently next time they experienced a stressful event to cope well with that situation?

## Measures

**Primary outcomes**. Every morning of the daily weekday assessments, participants noted the time they went to bed the previous night and the approximate time they fell asleep, and the time they woke that morning; they also reported the number of times during their evening sleep where they woke for 5 min or more in duration and the overall quality of their sleep on the previous evening (0% to 100%, with 10% increments). We calculated their overall sleep time as the time between which they reported falling asleep and waking up the next morning. Each evening, participants self-reported their psychological well-being using the 15-item version of the Well-Being Profile (Marsh et al., 2020). Participants assessed the degree to which each statement best described their personal circumstances that day using a 5-point rating scale with the following descriptive anchors: none of the time, rarely, some of the time, often, and all the time.

**Covariates**. At baseline, participants reported their typical self-reflection style on stressor experiences using a single-item: “When you reflect on stressor experiences, in general, to what extent do you do so as if you were a distanced observer of what was happening (i.e., watched the event unfold from the perspective of an observer, in which you could see yourself from afar) vs. an immersed participant in the experience (i.e., saw the event replay through your own eyes as if you were right there”). Participants assessed this item using a 5-point: 100% as an immersed participant, 75% as an immersed participant, 50% immersed/50% distanced observer, 75% as a distanced observer, and 100% as a distanced observer. In terms of typical sleep behaviour over the past week, participants indicated (i) how many hours of sleep per night they required to feel rested and recovered the following day, (ii) how many hours of sleep, on average, they obtained each night; and (iii) an overall assessment of the quality of their sleep (0% to 100%, with 10% increments). Each morning of

the daily survey, participants reported the number of times they woke for 5 min or more in duration the previous night.

**Attention check**. We included a single item ("Select 'Neither agree nor disagree' to show you are paying attention") to check participants' attention when they were approximately halfway through the baseline components. No Participants failed this attention check.

**Procedures**

Participants were first screened to ensure that they were eligible to take part in the study (i.e., did not have a sleep condition, did not take any medication that affects sleep, work regular daytime hours). Eligible participants were randomly assigned to either the self-immersed or self-distanced reflections condition by the software used to administer the study (Qualtrics). A baseline survey was sent to eligible participants on Sunday, which they could complete any time in the day. The baseline survey collected demographic information and measured baseline covariates (i.e., typical stressor responses, average sleep over the past week, number of hours required to feel rested). After completing these measures, participants then completed either the self-distanced or self-immersed reflection exercise.

Over the following five days (i.e., Monday – Friday), participants were provided with surveys each morning and evening. Morning surveys were available from 4:00-11:59 and recorded participants' sleep quality, duration, and the number of times they woke for five minutes or more. Evening surveys were available from 16:00-23:59 and measured participants' stressor responses and wellbeing. Participants were also asked to rate the severity of the most stressful event they encountered in the day and how well they coped with it. On average, participants completed surveys on 4.85 ($SD$ = 0.53) out of 5 days. The average times for morning and evening questionnaires were ~8am ($M$ = 7:59, $SD$ = 1:29 hours) and ~6pm ($M$ = 17:59, $SD$ = 2:09 hours), respectively.

## Statistical Analyses

**Pre-registered protocol**[1]. We tested the primary research questions within a mixed-effects modelling framework and restricted maximum likelihood estimation via the *nlme* package (Pinheiro et al., 2021) in R (R Core Team, 2020). Our pre-registered analytical protocol is available on the OSF project page (https://osf.io/ue9jm/)[2]. We first estimated a homogenous variance model that included a fixed effect of the experimental group on the primary outcome, adjusted for spontaneous self-reflection, hours of sleep per night to feel rested, as well as average sleep duration and quality the week prior to the study, with a random intercept for participants and homogenous between-person variance (Model 1a). Subsequently, we estimated a heterogenous variance model in which we expanded Model 1a to include heterogenous within-person and between-person variances (Model 1b). We formally tested the meaningfulness of the variance components via a log-likelihood test comparing Models 1a and 1b; a $p$ value < .05 indicates that we can reject the null hypothesis that the heterogenous variance model is a better fit than the homogenous variance model. Regarding interaction effects, we tested the moderating effect of stress mindsets and curiosity on the experimental effect of self-distanced reflections, adding fixed effects of these variables and their interaction with the experimental condition variable to the mean level and variance estimates of the heterogenous variance model only when it was deemed a better fit (Model 2a) or the homogenous variance model when the additional variance components were inconsequential (Model 2b). We formally tested the meaningfulness of the moderating effects of stress mindsets and curiosity via a log-likelihood test comparing the models with and

[1] We also planned as an exploratory test to examine the types of emotional regulatory strategies that mediate the effect of self-distanced reflections on sleep duration and psychological well-being. We decided against completing this analysis and reporting them here because of the mixed findings regarding the primary hypothesis.

[2] We updated the analysis script on 27th February 2022 because the original version contained potentially identifiable information (University name) in the file path for the working directory. No content changes were made.

without the moderator components; we utilised a maximum likelihood estimator for these model comparisons.

**Deviations from registered protocol**. Our pre-registered protocol included sleep duration and quality as well as psychological well-being as the primary outcomes, yet erroneously excluded the daily measures of stressor magnitude and stressor coping effectiveness as secondary outcomes that were included in our daily survey package with the pre-registration document[3]. Thus, we report them here as deviations in the spirit of transparency. Relatedly, we erroneously omitted spontaneous self-reflection, hours of sleep per night to feel rested, as well as average sleep duration and quality the week prior to the study as between-person (time-invariant) covariates and the number of times participants woke for 5 min or more each night as a within-person (time-variant) covariate in our pre-registered statistical script. These measures were included in our baseline and daily surveys attached with our pre-registration document, so we report them here as deviations in the spirit of transparency. Finally, we also planned to examine secondary outcomes – the degree of demand imposed by the most stressful event or situation experienced that day (stressor magnitude) and how well they coped with that stressor (stressor coping effectiveness) – and moderators of the main effect – degree to which participants are open and curious to complex, novel, or uncertain events or elements in their lives (Kashdan et al., 2009) and perceptions of the enhancing or debilitating nature of stress for their functioning (Crum et al., 2013). However, due to page constraints limiting our capacity to forecast the salience of these secondary outcomes sufficiently and likely being underpowered for the interaction tests, we report these results in the supplementary material only (see supplementary Figure S2 and Tables S2 and S3).

[3] For transparency, we replaced the baseline and weekly diary surveys on our OSF page on 26th January 2022 with blinded versions that redact identifiable information on our research team (e.g., university logo, contact email address).

## Results

The flow of participants through the experimental protocol is depicted in Supplementary Figure S1. Unadjusted descriptive statistics and omega coefficients (McDonald, 1970) for internal reliability estimates are presented in Supplementary Table S1. Model comparisons are provided in Table 1 and model estimates are reported in Table 2. In total, 318 individuals completed the baseline survey of which 308 completed two or more diary entries. The self-distanced and self-immersed reflection conditions originally had near equal numbers of participants; however, we excluded 51 participants from the self-distanced reflection condition because they wrote reflections in the first-person. The final sample ($n$ = 257; $n$ = 155 self-immersed condition, $n$ = 102 self-distanced condition) was predominantly Caucasian (90%), female (79%), aged 34.46 years ($SD$ = 8.34), and employed part-time (20%) or full-time (76%; 2% self-employed). At baseline, participants reported obtaining an average 6.79 hours of sleep per night ($SD$ = 0.96), which was less than what they reported requiring to feel rejuvenated ($M$ = 8.23 hours, $SD$ = 1.57).

Model comparisons indicated that the nature of one's self-reflection vantage point influenced within-person variability in the primary outcomes only for sleep quality, and not sleep duration and psychological well-being. In other words, the addition of heterogenous within-person variances to mean level estimates was inconsequential for all primary outcomes except for sleep quality (see Table 1). The group of participants who utilised a self-distanced perspective to reflect on their stressor experience showed greater variability in sleep quality between persons ($\tau_{0,\text{ self-distanced}}$ = 126.38) across the five weekday evenings compared with the between-person variability in the group of individuals who adopted a self-immersed perspective ($\tau_{0,\text{ self-immersed}}$ = 70.56). In other words, there were more individual differences in the group of people who utilised a self-distanced perspective with some people reacting positively to the approach and others not. We next focused on our key research

question regarding the variability within-persons. Results indicated that participants in the self-distanced condition had a residual variance of $\sigma^2 = 248.02$. The exponential variance function weight for the experimental group indicated that it had an around 8% higher residual variance ($\delta_1 = .084$). Findings regarding the fixed effects of the self-reflection manipulation on the primary outcomes were equivocal. Participants who reflected on their stressor experience from a self-distanced perspective on Sunday evening reported, on average, lower levels of sleep quality by 3.87% ($p = .024$) and improved well-being by .13 units ($p = .047$) each night across the subsequent working week, but not sleep duration (B = 5.88 min, $p = .36$). Collectively, these findings reflect an absence of evidence for our hypothesis for two of our three primary outcomes.

## Discussion

Our study represents the first experimental test of the differential effectiveness of self-distanced reflections relative to self-immersed reflections on mean levels as well as between- and within-person variability estimates of primary and secondary outcomes. In so doing, we offer three key findings. First, the distance from which one reflected on a recent stressor was largely inconsequential for mean levels and variability estimates of daily assessments across the 5-day period after that sensemaking process, except for sleep quality. Second, the degree of variability across the 5-day period was inconsequential for sleep duration, well-being, and perceptions of stressor magnitude and coping effectiveness, yet meaningful for sleep quality. Third, curiosity and stress mindsets are potentially interesting individual differences that might influence the effectiveness of self-distanced reflections, yet their importance requires unpacking in future work.

Prompting individuals to engage with stressor experiences retrospectively via reflexive processes enables them to extract lessons learned that can optimise future functioning (Crane et al., 2019a; Ellis et al., 2014). However, contrary to expectations that

self-distanced vantage points optimise this reflective process (Kross & Ayduk, 2017), we found that reflecting from a distanced perspective, overall, was no more effective than when the current self is fully immersed in the experiential reality of the event. Sleep quality was the only exception, whereby individuals who executed a self-distanced reflection of a stressor event reported lower mean levels and higher temporal variability. Giovanetti et al. (2019) reported similar contradictory findings regarding the adaptiveness of self-distanced reflections; they found that repeated self-reflections over a week increased depressive symptoms. Giovanetti et al. suggested that self-distancing may have been ineffectual because it reduced the generation of self-affirming statements and distance labelling, and because it is an unfamiliar form of writing. Considered in conjunction with Giovanetti and colleagues, therefore, our results raise questions regarding the robustness of the theoretical expectation that self-distanced reflections are always adaptive.

We suggest several other potential explanations for the mixed findings regarding the effectiveness of self-distanced reflections. First, although self-distanced reflections are adaptive for past and future stressor events that vary in emotional intensity (Orvell et al., 2021), our target stressor event may have been insufficiently salient to reap the benefits of a psychologically distanced reflection. We restricted the temporal resolution of the reflection window to 2-weeks because we expected stressor events in this period to be most influential for the target outcomes, particularly sleep, yet it could be that participants had already dealt with the stressor and therefore any lingering effects had disappeared. Second, most existing work on self-distanced reflections relies on single dosage manipulations in which participants execute a ‘one-off’ reflection and effectiveness is assessed shortly after execution (e.g., same lab session). When considered in conjunction with recent longitudinal experiments (e.g., Dorfman et al., 2021; Grossmann et al., 2021), our findings suggest that the adaptiveness of self-distanced reflections for temporally dynamic outcomes might be short-lived unless

deployed regularly. Third, the evidential value of the existing body of work on psychological distancing broadly is potentially questionable because of concerns regarding publication bias (Maier et al., 2022). Finally, it is possible that self-distanced reflections are simply no better than other types of reflection tactics. Narrative reviews (Kross & Ayduk, 2017) and meta-analytic estimates (Moran & Eyal, 2022; citation blinded for peer-review), overall, support the adaptive nature of self-distanced reflections, yet it is important to acknowledge the evidence is not unanimously positive (e.g., Giovanetti et al., 2019). In acknowledging the possibility that self-distanced reflections may be no better or worse than other forms of self-reflection strategies, we emphasise that a non-significant *p*-value does not necessarily indicate the absence of an effect (Greenland et al., 2016). Bayesian hypothesis tests (Keysers et al., 2020) and equivalence tests (Lakens et al., 2018) are two possibilities by which scholars might directly assess the strength of evidence for the null hypothesis in future research.

Key strengths of this study include the pre-registered methods and analytical protocol; transparency regarding deviations from our pre-registration; temporal restrictions on when participants could report their sleep and well-being metrics, thus maximising methodological consistency; and application of a statistical model that explicitly estimates within-person variability rather than rely on proxies such as individual standard deviation (see Lang et al., 2021). Nevertheless, readers are encouraged to assess these findings within the context of key study limitations. First, there is a presumption that our snapshot of 5-working days represents people's lived experiences fully; there may be unmeasured contextually or temporally salient factors that limit our confidence in this presumption. Sleep health, for example, is influenced by multiple, diverse factors (Hale et al., 2020). Second, we relied on self-reports of sleep duration, which are known to be overestimated relative to device-based (e.g., actigraphy) or polysomnography assessments (Matthews et al., 2018). Third, we excluded ~32% of

participants in the self-distanced reflection condition whose written reflections were incongruent with the essence of this manipulation. In our systematic review of the literature, among the 19 experiments that required participants to write down their self-reflections, as opposed to 'think about' their target event only (n = 6), authors checked the quality of the manipulation in 11 (~58%) of their protocols, including participants' self-reporting their adherence to the instructions via single-item question (n = 3), checks on the proportion of first and/or third person pronouns according to their experimental assignment (n = 7), and direct removal of participants who did not follow the experimental instructions for pronoun use (n = 1). Thus, an important consideration for future research on self-distanced reflections is to check the nature of participants' reflections capture the intent of the manipulation (see also, Fiedler et al., 2021).

We experimentally examined the differential effectiveness of self-distanced relative to self-immersed reflections on mean levels and within-person variability of sleep duration and quality as well as psychological well-being over a 5-day working week. Overall, our findings appear to contradict the expectation that self-distanced reflections are more adaptive than self-immersed reflections, yet they also shed light on substantive and methodological considerations that require interrogation in future research via experimental and longitudinal observational methods (Diener et al., in press). Broadly, we introduce or remind psychological scientists about mixed-effects models with heterogeneous variances as an analytical tool by which to operationalise within-person variability as something of substantive interest rather than a statistical nuisance.

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Table 1. Model comparisons for each outcome variable. Note: * maximum likelihood (ML) rather than restricted maximum likelihood (REML) estimation; grey shade = statistically significant value.

| | AIC | BIC | *logLik* | df | LRT | *p* |
|---|---|---|---|---|---|---|
| **Sleep Duration** | | | | | | |
| M1a: homogeneous variance model | 12669.13 | 12714.26 | -6325.57 | 9 | | |
| M1b: heterogeneous variance model | 12670.25 | 12725.40 | -6324.12 | 11 | 2.88 | .237 |
| **Sleep Quality** | | | | | | |
| M1a: homogeneous variance model | 9692.53 | 9737.68 | -4837.26 | 9 | | |
| M1b: heterogeneous variance model | 9688.29 | 9743.47 | -4833.14 | 11 | 8.24 | .016 |
| **Wellbeing** | | | | | | |
| M1a: homogeneous variance model | 1301.17 | 1345.56 | -641.59 | 9 | | |
| M1b: heterogeneous variance model | 1305.05 | 1359.31 | -641.53 | 11 | 0.12 | .943 |

Table 2. Model estimates for each outcome variable. Note: Note: SDR = self-distanced reflection; SIR = self-immersed reflection; estimates for the variance of SDR and SIR are presented on the exponential scale; grey shade = statistically significant value.

| | **Sleep Duration** | | | **Sleep Quality** | | | **Wellbeing** | | |
|---|---|---|---|---|---|---|---|---|---|
| | B | *SE* | *p* | B | *SE* | *p* | B | *SE* | *p* |
| **Location Effects** | | | | | | | | | |
| Intercept | 270.93 | 30.82 | <.001 | 58.81 | 7.76 | <.001 | 3.44 | 0.31 | <.001 |
| Experimental condition: SDR | -5.88 | 6.42 | .361 | -3.87 | 1.70 | .024 | -0.13 | 0.06 | .047 |
| Spontaneous self-reflection | -0.16 | 0.17 | .361 | -0.02 | 0.04 | .676 | 0.00 | 0.02 | .609 |
| Hours needed to feel rested | 7.89 | 3.32 | .018 | -1.1 | 0.82 | .218 | -0.05 | 0.03 | .121 |
| Sleep duration past week | 20.32 | 3.75 | <.001 | 1.46 | 0.93 | .118 | 0.07 | 0.04 | .079 |
| Sleep quality past week | -0.18 | 0.22 | .411 | 0.23 | 0.05 | <.001 | 0.01 | 0.00 | .021 |
| Number of wakes per night | 0.69 | 1.42 | .627 | -6.96 | 0.36 | <.001 | -0.01 | 0.01 | .315 |
| **Scale Effects** | | | | | | | | | |
| Variance for SIR | | | | 126.38 | | | | | |
| Variance for SDR | | | | 70.56 | | | | | |
| $\delta_1$ | | | | .084 | | | | | |
| Intercept | 1497.45 | | | | | | 0.21 | | |
| Residual variance | 3900.65 | | | 248.02 | | | 0.12 | | |

# Supplementary Material

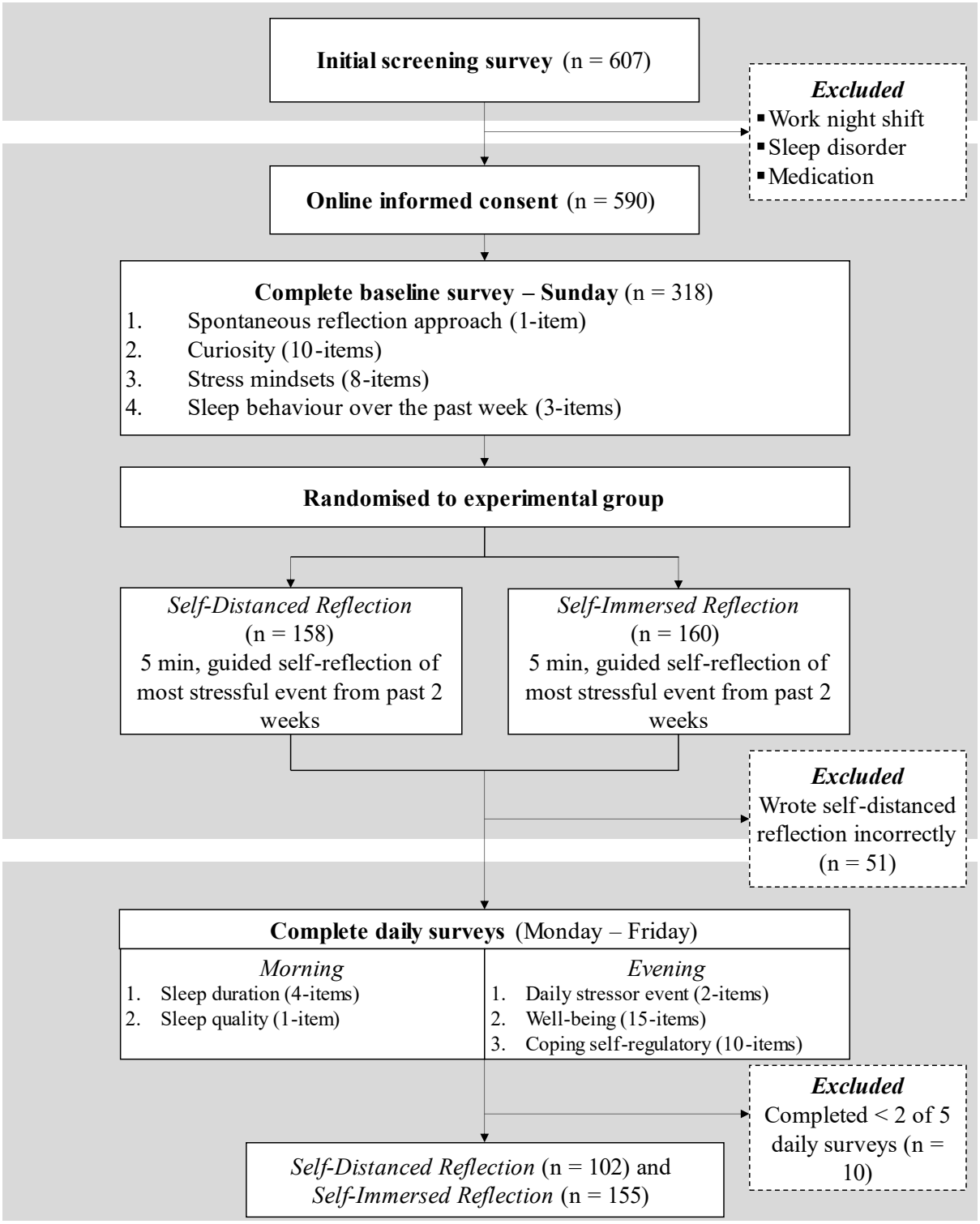


Figure S1. CONSORT flow diagram of study procedures and participants.

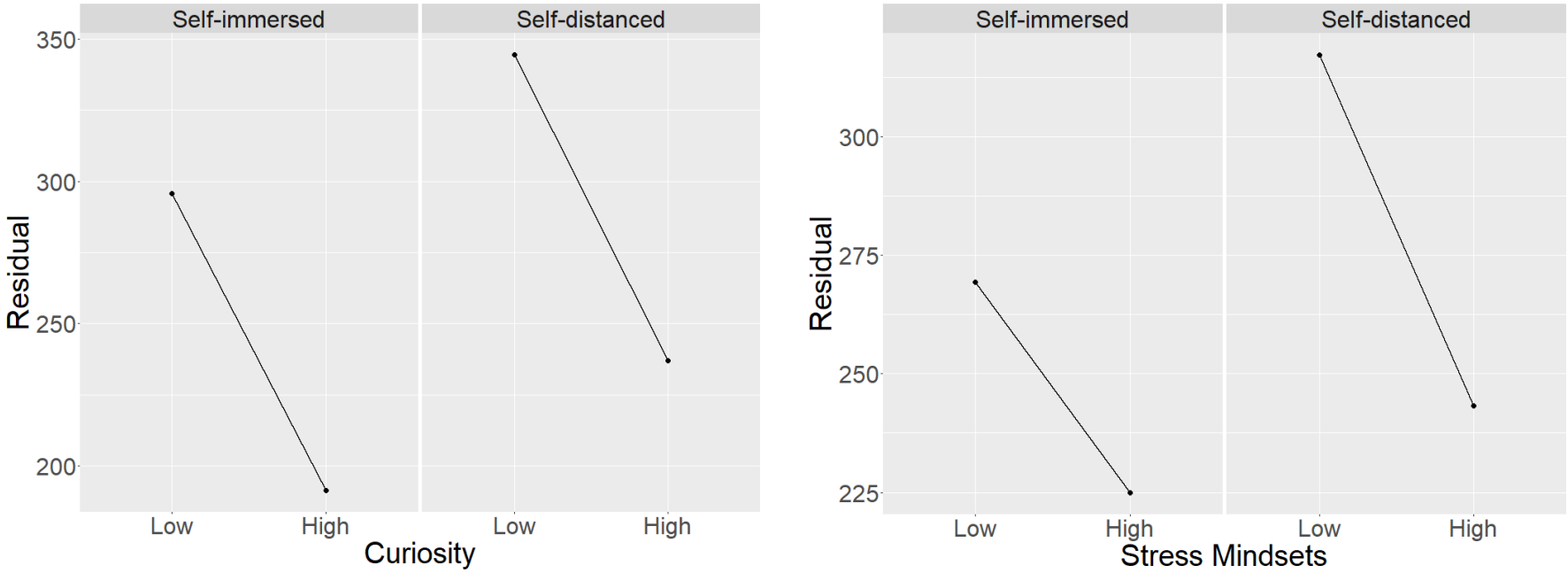


Figure S2. Visual depiction of interaction effects between experimental condition with curiosity (left) and stress mindsets (right).

Table S1. Descriptive statistics and reliability coefficients (ω) for total sample.

| | *M* | *SD* | ω between-subjects | ω within-subjects |
|---|---|---|---|---|
| Sleep duration (hours) | 7.514 | 1.229 | | |
| Sleep quality | 61.421 | 15.508 | | |
| Psychological wellbeing | 3.660 | .501 | .941 | .794 |
| Stressor magnitude | 37.774 | 17.733 | | |
| Stressor coping | 75.598 | 15.040 | | |
| Curiosity | 4.423 | .896 | .872 | |
| Stress mindset | 3.479 | .612 | .718 | |
| Spontaneous self-reflection | 72.222 | 18.199 | | |
| Sleep duration past week (hours) | 6.556 | 1.075 | | |
| Sleep quality past week | 62.222 | 17.487 | | |
| Hours needed to feel rested | 7.904 | 1.039 | | |
| Number of wakes per night | 1.557 | 1.348 | | |

Note: omega (ω) available for within-subjects only for assessments reported daily.

Table S2. Model comparisons for each secondary outcome and moderator variable. Note: * maximum likelihood (ML) rather than restricted maximum likelihood (REML) estimation; grey shade = statistically significant value.

| | **Stress Mindsets** | | | | | | **Curiosity** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AIC | BIC | *logLik* | df | LRT | *p* | AIC | BIC | *logLik* | df | LRT | *p* |
| M1a: homogeneous variance model | 9803.90 | 9848.30 | -4892.95 | 9 | | | | | | 9 | | |
| M1b: heterogeneous variance model | 9807.38 | 9861.65 | -4892.69 | 11 | 0.41 | .773 | | | | 11 | | |
| M1a: homogeneous variance model* | 9807.48 | 9851.94 | -4894.74 | 9 | | | 9807.48 | 9851.94 | -4894.74 | 9 | | |
| M2b: homogeneous variance model with moderator* | 9808.96 | 9863.30 | -4893.48 | 11 | 2.52 | .283 | 9803.27 | 9857.61 | -4890.64 | 11 | 8.21 | .017 |
| **Stressor Coping** | | | | | | | | | | | | |
| M1a: homogeneous variance model | 9517.76 | 9562.17 | -4749.88 | 9 | | | | | | 9 | | |
| M1b: heterogeneous variance model | 9519.33 | 9573.59 | -4748.66 | 11 | 2.44 | .295 | | | | 11 | | |
| M1a: homogeneous variance model* | 9518.61 | 9563.07 | -4750.30 | 9 | | | 9518.61 | 9563.07 | -4750.30 | 9 | | |
| M2b: homogeneous variance model with moderator* | 9522.02 | 9576.36 | -4750.01 | 11 | 0.59 | .745 | 9521.46 | 9575.80 | -4749.73 | 11 | 1.15 | .563 |

Table S3. Model estimates for each secondary outcome with curiosity and stress mindsets as the moderator. Note: Note: SDR = self-distanced reflection; SIR = self-immersed reflection; estimates for the variance of SDR and SIR are presented on the exponential scale; grey shade = statistically significant value.

| | **Curiosity** | | | | | | **Stress Mindsets** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Stressor Magnitude** | | | **Stressor Coping** | | | **Stressor Magnitude** | | | **Stressor Coping** | | |
| | B | *SE* | *p* | B | *SE* | *p* | B | *SE* | *p* | B | *SE* | *p* |
| **Location Effects** | | | | | | | | | | | | |
| Intercept | 35.64 | 11.32 | .002 | 82.04 | 9.43 | .000 | 33.34 | 11.72 | .005 | 80.85 | 9.64 | <.001 |
| Experimental condition: SDR | 4.82 | 2.34 | .041 | -2.71 | 1.95 | .165 | 5.17 | 2.38 | .031 | -2.59 | 1.96 | .187 |
| Curiosity | 3.60 | 1.68 | .033 | -0.51 | 1.40 | .714 | 2.10 | 2.59 | .418 | 0.97 | 2.13 | .651 |
| Curiosity x SDR | 0.43 | 2.55 | .867 | 2.13 | 2.12 | .315 | 1.83 | 3.80 | .632 | 0.48 | 3.12 | .878 |
| Spontaneous self-reflection | 0.05 | 0.06 | .463 | -0.01 | 0.05 | .793 | 0.04 | 0.07 | .528 | -0.01 | 0.05 | .848 |
| Hours needed to feel rested | 1.09 | 1.21 | .371 | -1.35 | 1.01 | .181 | 1.04 | 1.25 | .407 | -1.25 | 1.02 | .223 |
| Sleep duration past week | -2.73 | 1.37 | .048 | -0.27 | 1.14 | .815 | -2.56 | 1.39 | .067 | -0.18 | 1.14 | .872 |
| Sleep quality past week | 0.08 | 0.08 | .346 | 0.16 | 0.07 | .023 | 0.11 | 0.08 | .178 | 0.15 | 0.07 | .027 |
| Number of wakes per night | 0.37 | 0.57 | .516 | -0.67 | 0.49 | .173 | 0.25 | 0.57 | .664 | -0.71 | 0.49 | .146 |
| **Scale Effects** | | | | | | | | | | | | |
| Variance for SIR | | | | | | | | | | | | |
| Variance for SDR | | | | | | | | | | | | |
| $\delta_1$ | | | | | | | | | | | | |
| $\delta_2$ | | | | | | | | | | | | |
| $\delta_3$ | | | | | | | | | | | | |
| Intercept | 152.01 | | | 90.96 | | | 160.92 | | | 91.01 | | |
| Residual variance | 651.57 | | | 510.62 | | | 650.70 | | | 510.89 | | |