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David L. Dickinson
Appalachian State University

Sean P.A. Drummond
Monash University

Department of Economics
Appalachian State University
Boone, NC 28608
Phone: (828) 262-2148
Fax: (828) 262-6105
www.business.appstate.edu/economics

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David L. Dickinson

Appalachian State University, IZA, ESI.

Boone, NC. 28607, USA. Email: dickinsondl@appstate.edu

Sean P.A. Drummond

Monash University

Abstract:

Story telling is part of life, and the retelling of stories is an important form of communication, cultural practice, and message transmission. Insufficient sleep is known to affect relevant cognitive skill areas necessary for story retelling or transmission fidelity. We conducted a preregistered study on n=118 young adults who were administered a week each of restricted and well-rested sleep levels in their home environment (37 additional control participants were well-rested both treatment weeks). A serial story reproduction task was administered online, and the content of story retells was examined regarding the preservation of characters, details, and the key story event. Chains of up to 3 retells of a given story were examined, which involved varied numbers of sleep restricted (SR) versus well-rested (WR) retellers. While all retells of a story showed an average decay in content, results show that additional SR retellers in a chain was associated with greater decay, which mostly resulted from the introduction of an initial SR reteller at the beginning of the chain. Supporting the group-level effect, individual-level analysis confirmed that both the number of details and the story's key event were significantly less preserved after the SR compared to WR treatment week. Exploratory analysis showed an attenuation of this effect in those who reported a higher level of affective response (interest or surprise) in the story. This suggests that emotional engagement is important in combatting the deleterious effects of SR on successful story retelling, and perhaps on other types of content recollection.

Key Words: Sleep restriction, cognition, communication, information transmission

JEL Codes: C91, D90, D83

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Intro

While communication takes on various forms, the ability to accurately retell a story or other information has relevance in many different arenas (e.g., workplace, social networks, family communications, etc). The relay of information or message content has important safety implications in some occupational settings, such as with emergency services work, medical settings, or air traffic control. In other instances, story retelling can have legal implications, such as with witness testimonies. Additionally, in educational settings retelling is considered a generative learning strategy (Wilson et al., 1985) and, though limitations exist and its efficacy has not yet been validated, retells are commonly used for reading comprehension assessments for K-12 education (Reed and Vaugh, 2012; Cao and Kim, 2021). Finally, story retelling is an important means to transmit cultural knowledge in many parts of the world. A systematic study of factors that influence the accuracy of retells can therefore offer insights into a rather wide range of environments where comprehension and/or communication reliability matter. Because much of the population functions on insufficient sleep (Schoenborn and Adams, 2012; Hafner et al., 2017; Gordon et al., 2019), it is important to understand how information relay may be affected by one's sleep state. Our study aims to further our understanding of how commonplace levels of insufficient sleep affect retells in a serial story reproduction task.

Background

While accurately relaying facts of a story is clearly important, it may depend on what information the recipient is believed to already possess. Higgins et al. (1982) studied verbal communication and found that the reproduction of information was more accurate and complete when the source relayed information to a recipient believed to have different information, as opposed to having information similar to the source communicator. It is also the case, however, that information transmission may not be the only relevant aspect of communication (Higgins, 1992). Conveying the emotional appraisal of a narrative is important because the affective valence of words can be remembered better than actual words, as noted in a telephone game serial reproduction study (Breithaupt et al., 2018). Breithaupt et al. (2022) further suggest that emotional appraisals in story retelling can be an anchor to help remember story content, though this is clearly of more importance in narrative communication. Different types of communication media also factor into the fidelity of serial story reproduction, and several studies have documented that a print and online story (visual-only story) recall are similar and of higher fidelity than

the same story delivered by radio (audio-only) or television (audio-visual) (DeFleur and Cronin, 1991; Sundar et al, 1998; DeFleur et al., 1992; Facorro and DeFleur, 1993).

A foundational theoretical proposition in communications research is that communication fidelity is enhanced when both the source and recipient have sufficient physiological and cognitive processing skills (Powers and Will, 2008). This implicates any temporary state of impaired cognition as problematic as it pertains to message relay and communication fidelity. The known effects of sleep deprivation on cognition (Lim and Dinges, 2010), as well as the specific cognitive function relevant to communication fidelity (e.g., verbal working memory, verbal learning), suggest sleep loss is likely to result in a breakdown in communication fidelity, though research has been limited in this area. To our knowledge, few studies examine the effects of sleep deprivation on communication (e.g., Holding et al., 2019; Pilcher et al., 2007), and their focus has been on interpersonal verbal communication of the sort where numerous cognitive domains are involved (e.g., verbal fluency and perception, linguistic comprehension, audio processing). Our study is fundamentally different in its focus on serial story reproduction that does not involve face-to-face communication, social interaction, or audio processing.

Methods

The sleep protocol was preregistered on the Open Science Framework (OSF) (https://doi.org/10.17605/OSF.IO/NSPRK) and as a clinical trial with ClinicalTrials.gov (identifier NCT05728983). The telephone task study was separately preregistered (https://doi.org/10.17605/OSF.IO/H4Z6N), to include study design, hypotheses, sample size and analysis plans.

The Sleep Protocol

Participants were screened to meet our inclusion criteria: young adult (18-40 years of age), non-extreme diurnal preference type, non-significant risk of major depressive or generalized anxiety disorder, no self-reported sleep disorder (or suspected disorder), no dietary restrictions. Publicized cutoffs were used to assess diurnal preferences (Adan and Almirall, 1991), and risk of major depressive (Kroenke et al., 2003) and generalized anxiety (Spitzer et al., 2006) disorders. Most participants were college students at a mid-sized regional university. Eligible participants were randomly assigned to a treatment or control

condition for a 3-week study, where Weeks 1 and 3 involved prescribed sleep levels to take place in one's at-home naturalistic environment. Participants wore a wrist-based actigraphy device (the Actiwatch Spectrum Plus) for the duration of the study, and they also kept daily sleep diaries that would assist in identifying the start and end of each attempted sleep intervals—manufacturer software (Actiware version 6.1) was then used to the score each 30-second epoch of data as either sleep or wake to determine sleep duration for that night. Measures of sleepiness and perceived impairment and cognitive function were also elicited via survey at the end of a treatment week.

The well-rested (WR) condition assigned 8-9 hours attempted sleep each night for a full 7 nights, while the sleep-restricted (SR) condition assigned 5-6 hours attempted sleep each night for a full 7 nights. Week 2 of the protocol was always a washout week of ad lib sleep for the participant, while treatment participants underwent either a SR-WR or WR-SR treatment order for the weeks 1 and 3 sleep conditions. Control participants were assigned WR-WR for both treatment weeks 1 and 3. Condition and sleep condition order (for treatment participants) were randomly assigned prior to recruitment, at which point participants were invited to participate in the 3-week study.

While the sleep study included laboratory sessions at the end of each sleep treatment week where compensated decision tasks were administered, the telephone task was administered via an online survey sent to participants after the 6th night of the protocol. As such, participants would have experienced a full 6 nights of the sleep treatment prior to completion of the telephone game task. The task was described as a required task for participation in the study, but no additional compensation (beyond the compensation they would already receive for participation) was given for completing the task.[1]

The Telephone Game task

The original set of 3 stories (Breithaupt et al., 2018) were supplemented with 3 additional stories we constructed and pilot tested for similarity. Stories were intended to be similar in number of characters, details, and the fact that a key event (detail) was presented in each story to resolve the core problem

[1] While the idea of incentivizing the task to motivate accuracy was attractive, as a practical matter we chose to not incentivize the task given its online delivery. The concern was our lack of control over participants possibly copying (e.g., screenshot or photo) the story to ensure accurate retelling. In such an instance, the task would then confound the retelling with a moral choice environment where there would a temptation for dishonesty, which has been found to increase when sleep restricted (see Dickinson and Masclet, 2023).

present in that story. For pilot testing, a set of 20 participants were recruited via Prolific read the stories online via survey software (Qualtrics) and typed their retelling of each story immediately after reading that story. The retold stories were then presented to a unique set of 20 participant to complete a 2nd retelling of each story, which were used to generate 3rd retellings of each story from another unique set of 20 participants. The fidelity of retold stories was assessed regarding number of characters, details, and key event preservation. Summary results in the Appendix show that the newly generated Amanda (A), Jessica (Je), and Eric (E) stories compared favorably on these dimensions with the original Robert (R), Sarah (S), and Jason (Ja) stories. We noted that the key event was preserved at a somewhat higher rate in the newly constructed stories, and so we generated our two sets of 3-stories or the main study by mixing and matching original and new stories—we created sets of Robert-Erica-Jessica (R-E-Je) and Jason-Amanda-Sarah (Ja-A-S). The ordering of the story blocks R-E-Je versus Ja-A-S was varied across participants both within and across cohorts, with each participant retelling each of the 6 stories exactly once (3 stories at the end of each sleep treatment week, presented in randomized order in the survey; see Appendix A for details). After retelling a story, we elicited participants' self-reported affective ratings on a 1-9 Likert scale for *Surprise* (how surprised you were in the story) and *Interest* (how interested you were in the story).

To facilitate the creation of 1st, 2nd, and 3rd retellings for the main study, we organized the design using sets of 3 cohorts of participants, with each cohort being between 8-16 participants. For example, Cohort 1 would complete retellings from the original source stories. These retellings were then used as the source stories that participants of cohort 2 would see when administered the task. Their 2nd retellings were then used as source stories for cohort 3 in order to create 3rd retellings of each story. This process was used for Cohorts 1-3 participants, Cohorts 4-6 participants, and Cohorts 7-9 participants. Our data collection was completed after 11 Cohorts of participants, and so adjustments to this process were used to present different retold source stories to subsets within the final cohorts with a goal of increasing the number of observations of 3rd retellings generated from a chain or *all* SR or *all* WR participants at each stage. This process was used to generate our data, which inevitably led to some differences in the number of observations for each level of retelling. Two research assistants independently scored each story for characters, details, and event preservation using the same rubric created for the pilot data. One of the experimenters independently scored the retelling of a story in the event the research assistants' independent scoring differed by more than 5 details or if there was any disagreement in the key event preservation scoring (where scoring allowed a key event preservation = 0, .5, or 1, with .5 representing that the key event was preserved "in part").

Preregistered Hypotheses[2]

Our hypotheses were derived from existing empirical evidence, including the extant literature highlighting the negative impact of sleep restriction on cognition (Lim and Dinges, 2010), along with the aforementioned research highlighting the important of cognition on message relay fidelity (Powers and Will, 2008). The hypothesis H1b below is a replication test of a key affective response result reported in (Breithaupt et al., 2018), which suggested the resiliency of emotional appraisal of a story even when retold with less content accuracy.

H1a: Character count, detail content, and story event preservation will decline with each retelling of a story.

H1b: Average surprise ratings of a story will stay the same across retellings.

H2: Across multiple retellings of a story, the decline in character count, details preserved, and key event presence will be more significant the more SR participants are in the chain of story retellings.

H3-H5: Character count (H3), Details (H4), and Key Event Preservation (H5) will decline more when story is retold by a SR participant (compared to the same participant while well-rested, WR).

Results

A total of n=155 participants (n=118 treatment, n=37 control) completed the study. The sleep protocol significantly affected both objective sleep and subjective sleepiness measures across treatment weeks as anticipated. Specifically, during SR compared to WR, participants had lower (objective) actigraphy-measured night sleep ($p < .001$), as well as self-reporting higher sleepiness ($p < .001$), lower perceived cognitive functioning ($p < .001$), lower positive mood ($p < .001$), higher negative mood ($p < .001$), and a self-assessment of sleep less during the previous week more than typically ($p < .001$).[3] The sleep

[2] We varied the order of the hypotheses here relative to our preregistered hypotheses ordering for ease of exposition, without altering the set of preregistered hypotheses examined.

[3] All results were from Z-tests of the treatment group outcomes. For the control group participants, we found no significant differences across these measures comparing outcomes at the end of the first and the last WR treatment weeks ($p > .05$).

protocol was therefore successful at generating a meaningful difference in within-subject sleep in our treatment group sample.

Telephone game task outcomes were assessed both at the individual retell observation level, as well as across serial retell chains of up to 3 retells. Hypotheses 1a and 1b are tests of main effects of retells fidelity and affective assessment of the story, intended to test for replicability with Breithaupt et al. (2018). Table 1 shows results from regressions predicting the level of fidelity loss across story characters, details, and key event preservation. Indicators for 2nd and 3rd retells are the key coefficient estimates of interest, along with the constant term that describes the level of content decay during the average 1st retell of a story. The test at the bottom of Table 1 highlight support for Hypothesis 1a by showing that average levels of decay along all dimensions is significantly negative at each retell—the positive coefficients on the Retell2 and Retell3 indicators indicate the fidelity is lost at a lesser rate in subsequent retellings compared to the first retelling. Hypothesis 1b is tested by examining self-reported *Surprise* and *Interest* ratings after each retell, and here the data do not fully support H1b. Specifically, we find that *Surprise* and *Interest* ratings do not change from the 1st to the 2nd retell of a story, but they decline at the 3rd retell in the chain (see Appendix B Table B1). It is also the case that the average *Surprise* and *Interest* ratings are lower during SR ($p < .001$ in both instances: 2-sample Z-test), and the decline in *Surprise* upon 3rd tell are greater during SR (again, see tests on the relevant linear coefficient combination tests at bottom of Table B1).

Hypothesis 2 is a test that the chain of retells will suffer more as more SR participants are in the chain. We present these results in Figure 1, which shows cumulative decay levels across retellings by the number of SR vs. WR retellers in the chain—here, the general decay from one-retell to two-retells to three-retells is another reflection of the Hypothesis 1a support. To test Hypothesis 2, we test for significance across outcomes from pooling all retells derived from a specific number of SR participants in the chain (two-sample Z-tests are used). In general, while there is some support for the claim that more SR retellers in the chain will cause a greater decay in story fidelity, the support is somewhat mixed. In the two upper panel, results for the analysis of *Characters* and *Details* decay show at least some evidence that more SR retellers significantly reduces preservation of these story features. However, as seen in the blocks of two- and three-retell data, it is clear that the additional SR reteller does not necessarily increase *Characters* or *Details* decay at the margin. And, when examining *Event Preservation* measures, the only statistically significant decay due to SR retells is found in the three-retell data that compared *Event Preservation* of a story retold three times by all SR compared to all WR participants.

Given the mixed results from the pooled data on serial retell outcomes, we next examine Hypotheses 3-5 using individual-level analysis of retell outcome. Here, our data are structured as a panel data set with 6 observations per participant.[4] We estimated models to predict the amount of *Characters, Details,* or *Event Preservation* retained in the retell relative to the source story that one saw. Thus, a participant who completed a 2nd or 3rd retell of the story has her outcomes compared to the amount of *Characters, Details,* or *Event Preservation* that was present in the 1st or 2nd retell, respectively, that was viewed as the source story for that participant. Models were estimated using the binary SR indicator, with several other specifications used to perform sensitivity analysis. The sensitivity analysis included using continuous average total nightly sleep time (actigraphy measured) as the key sleep measure of interest and a sample-selection corrected weighted regression approach (the inverse probability weight, or IPW, correction specification).[5] Finally, we estimated models with and without additional covariates to control for demographics, a cognitive reflection measure (CRT score), a repeat administration control for end Week 3 versus end Week 1 retells, and story fixed effects. We refer to the specifications with or without additional covariate controls in the model as "controls" versus "simple" specifications, respectively.

The results are summarized via coefficient plots in Figure 2, with full results in Appendix B, Tables B2-B4. We find no significant impact of sleep (SR or total nightly sleep time) on *Characters* preserved in a retell, but less total nightly sleep is estimated to significantly reduce the number of *Details* preserved ($p < .05$). The findings are more robust with respect to the impact of sleep restriction on *Event Preservation*, where we find robust evidence that SR (or lower levels of nightly sleep) significantly lowers *Event Preservation*.

While these participant-level findings regarding the impact of SR on *Event Preservation* would seem to favor a more general evidence of fidelity decay in the pooled data on retell chains (Figure 1), the affective state reports on *Surprise* and *Interest* given after each story retell allowed for an exploratory analysis that helps elucidate this result. For this, we split the data into subsets of those who expressed a particularly high level of affective engagement on either measure versus those with lower affective

[4] A few observations were lost due to a participant inadvertently advancing the screen in the online survey prior to reading the story, which participants reported to us upon completion of the survey. Regarding *Event Preservation*, we have fewer observations due to some retells having completely lost the key event in the retell, such that we could not then calculate a decay rate outcome for the subsequent retell.

[5] The IPW correction is a weighted regression that accounted for sample selection in the number of participants originally enrolled in the study (n=176) compared to those completing the study (n=155: n=118 Treatment, n=37 Control)—the first-stage selection equation estimation results are shown in Appendix B, Table B5.

engagement. *Surprise* and *Interest* reports were given on a 9-point Likert scale and scored high engagement as those who self-reported 7-9 on either measure. Estimations results from the split samples are summarized with coefficient plots for *Details* and *Event Preservation* outcomes in Figure 3 (results in the split samples showed no differences for *Characters,* and so we omit those outcomes from the Figure 3 outcomes and relegate them to Appendix B (see Tables B6-B8)). While the high engagement subsets of *Surprise* and *Interest* retells represent fewer observations and, as a result, wider confidence intervals on the coefficient estimates measures the sleep affect, it is nonetheless clear that any significance of sleep effects appear to result from the subset of *less* engaged participants (i.e., lower levels of either *Surprise* or *Interest* in the story that she just retold). This is most clear in the lower panel result showing split sample estimates of sleep effect on *Event Preservation* by high- and lower-engagement.

DISCUSSION

The goal of this paper was to present novel evidence regarding how commonly experienced levels of insufficient sleep likely impact the fidelity of story reproduction. The narrative story reproduction task we examined represents a type of building-block task that can help further our understanding in the more broad domain of communication that involves information transmission. Furthermore, though we only elicited the retelling of a given story once per participant, how one retells a story can have future implications because it has been shown that we may subsequently remember a story in a way that aligns with our own distorted retelling (Barber and Mather, 2014).

Retelling stories is an activity that occurs regularly in everyday life (Reese et al., 2011), and how different categories of details are recalled differs by age and gender (Davis et al., 2015). Whether the effects of sleep loss on cognition show sex difference has shown some mixed results, but there are well-known sex-related differences in episodic memory of the sort that is relevant to story retelling (Hajali et cl., 2019). If sleep pressure builds more quickly in women than men (Mong et al., 2011), or if women recover from sleep pressure more slowly (Armitage et al., 2001), then it is likely that insufficient sleep has differential impacts by sex on cognitive function relevant to story retelling (Hajali et al., 2019). We did not preregister plans to examine sex differences in the SR effects in our study, but an exploratory examination of the individual SR effects on story retell outcome measures for the separate subgroups of male (n=67) and female (n=88) participants in our study do not show clear differences by sex in the Figure 2 findings (see Appendix Figure A2 for coefficient plots of these results by sex).

Of course, limitations of our study must be recognized. We only study narrative reproduction, in a form that is written (visual) with a typed retell. Many environments may count on oral communication, and environments where message relay needs to be accurate with high stakes likely motivate individuals to use other tools to help recall key details, rather than rely on memory alone (e.g., written or recorded records, etc). Participants in our study were not incentivized to accurately recall and retell the story, though we highlighted previously the trade-off faced in our particular online task that led to our methodological choice (see Footnote 1). Our particular focus on relatively mild sleep restriction may apply to many, but it does not reflect all the variety of levels of insufficient sleep or types of adverse sleep states experienced by many. Also, participants here were mostly young adults in college, which implies that additional research is needed to generalize our findings to a more broad range of demographics.

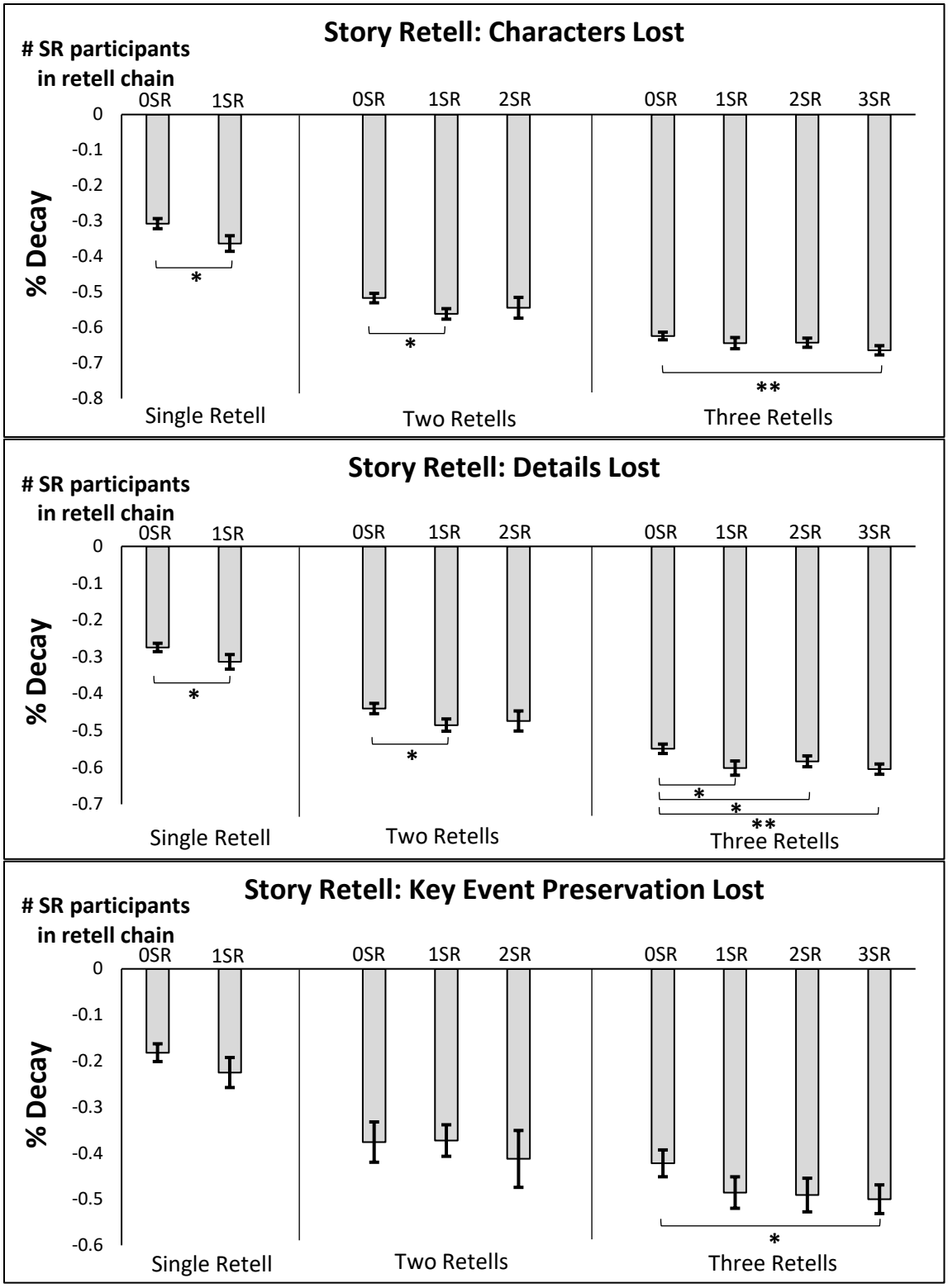
Our key findings highlight that, while serial reproduction of a narrative is somewhat destined to manifest some decay in content relayed, this effect is likely to be worse in a household or workplace or context where individuals with insufficient sleep are involved. An important exploratory finding is that this SR effect seems most prevalent when one did not report high *Interest* or *Surprise* in the story. In other words, an emotional engagement with the story may provide some resiliency against the detrimental effects of SR on story retell fidelity. Thus, efforts to emotionally engage when sharing important story content has potential as a countermeasure against deleterious SR effects, although efforts to increase sleep or improve sleep hygiene are a more direct way to deal with any SR-related concerns in communication. Also, because the task we studied avoided additional cognitive domains relevant to communication (e.g., face-to-face queues, social interaction, audio processing), but yet they are known to be negatively impacted by short-term sleep loss (see Beattie et al., 2015), our study can be considered a somewhat conservative assessment of the impact of sleep restriction on serial information reproduction.

TABLE 1: The impact of retelling on story reproduction

VARIABLES	(1) % Characters Lost	(2) % Details Lost	(3) % Event Preservation Lost
Retell2 (=1)	0.06	0.07*	0.03
	(0.03)	(0.03)	(0.05)
Retell3 (=1)	0.13**	0.08**	0.12**
	(0.03)	(0.02)	(0.04)
Age	0.01**	0.01**	0.00
	(0.00)	(0.00)	(0.01)
Female (=1)	0.08**	0.10**	0.09*
	(0.03)	(0.02)	(0.04)
Minority (=1)	0.02	0.02	0.06
	(0.03)	(0.02)	(0.06)
MEQ	0.01**	0.01*	0.00
	(0.00)	(0.00)	(0.01)
CRTscore	0.02**	0.02**	0.02
	(0.01)	(0.01)	(0.01)
Repeat Administration (=1)	0.01	0.01	-0.04
	(0.01)	(0.01)	(0.04)
Constant	-0.83**	-0.71**	-0.38*
	(0.10)	(0.08)	(0.15)
Observations	924	924	851
# Participants	155	155	155
Story Fixed Effects	YES	YES	YES
R-squared	0.185	0.154	0.0276
Tests of decay by retell #			
1st Retell test: H_0: Constant term = 0	-0.83**	-0.71**	-0.38*
2nd Retell test: H_0: X^2 test Constant + Retell2 = 0	65.10**	69.26**	5.01*
3rd Retell test: H_0:X^2 test Constant + Retell3 = 0	48.84**	66.33**	2.93*

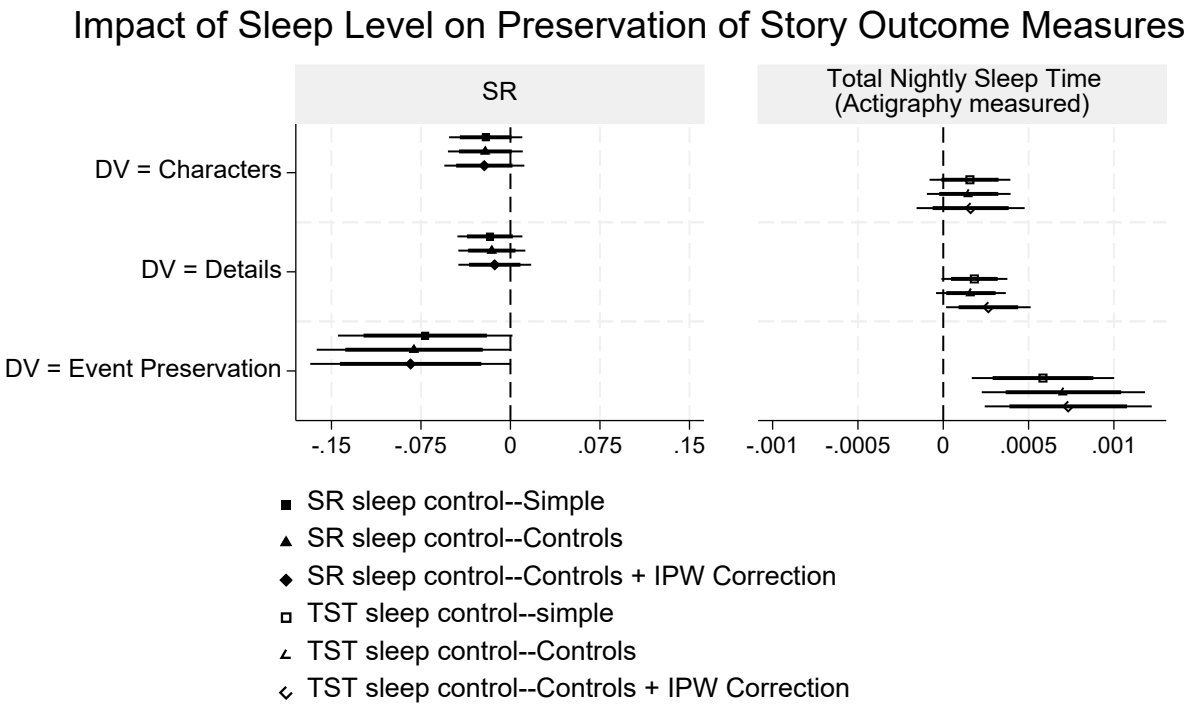
Notes: ** p<0.01, * p<0.05 for the 1-tailed (preregistered) test. Robust standard errors in parentheses

FIGURE 1: Serial reproduction chain outcomes—the influence of SR



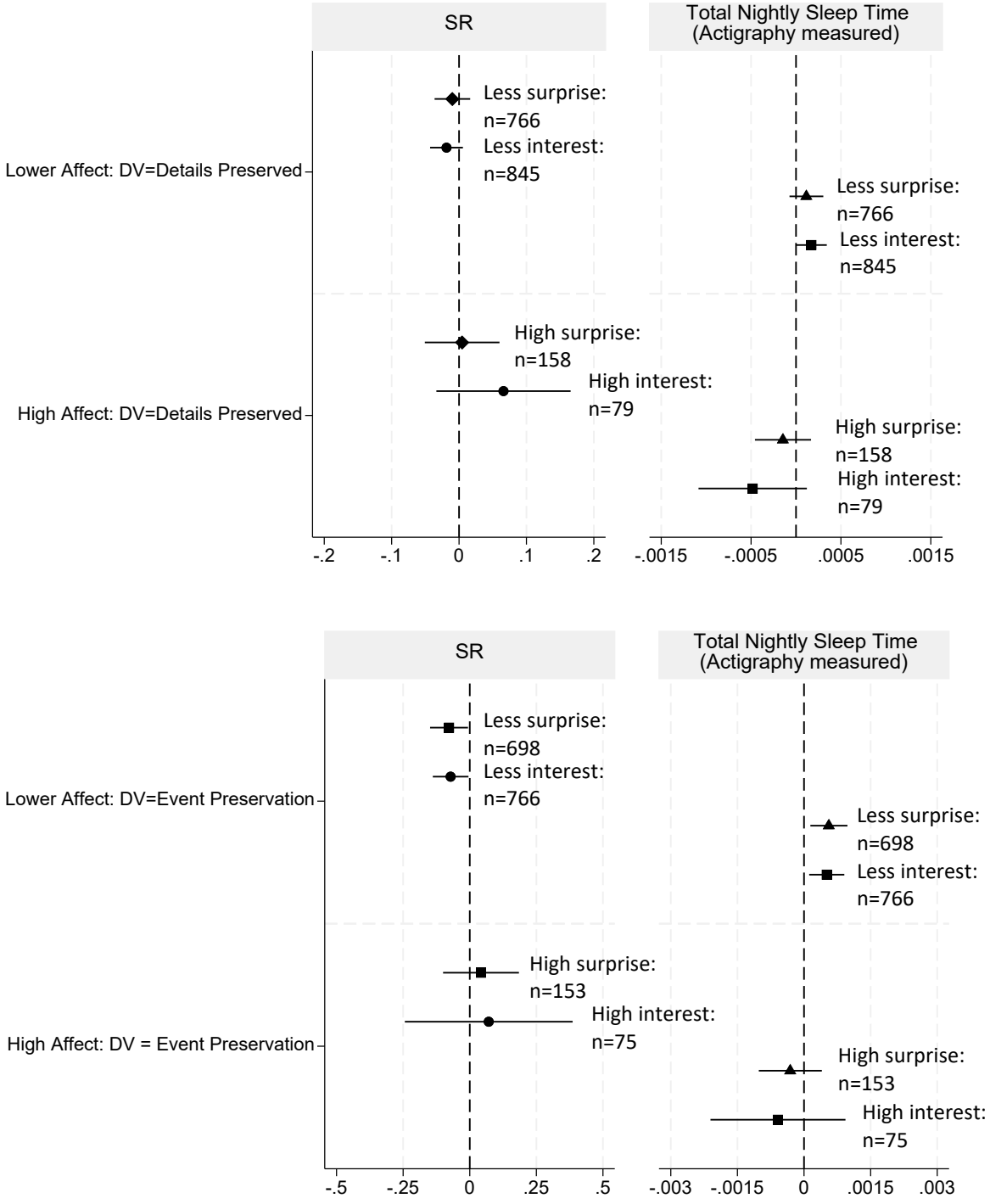
Notes: *$p < .05$, **$p < .01$ for the one-tailed (preregistered) two-sample Z-test comparisons.

FIGURE 2: Individual level retell outcomes—the influence of SR



Notes: Plot shows the coefficient estimate with the 99% (thin line) and 95% (thick line) 1-tail test confidence interval on the preregistered hypothesis. Full estimation results are in Appendix B, Tables B2-B4.

FIGURE 3: Individual level SR effects as moderated by affective engagement



Notes: Plot shows the coefficient estimate with 95% 2-tailed test confidence interval on what we consider an exploratory hypothesis of an affect-based moderation of the SR effect. Full estimation results are in Appendix B, Tables B6-B8.

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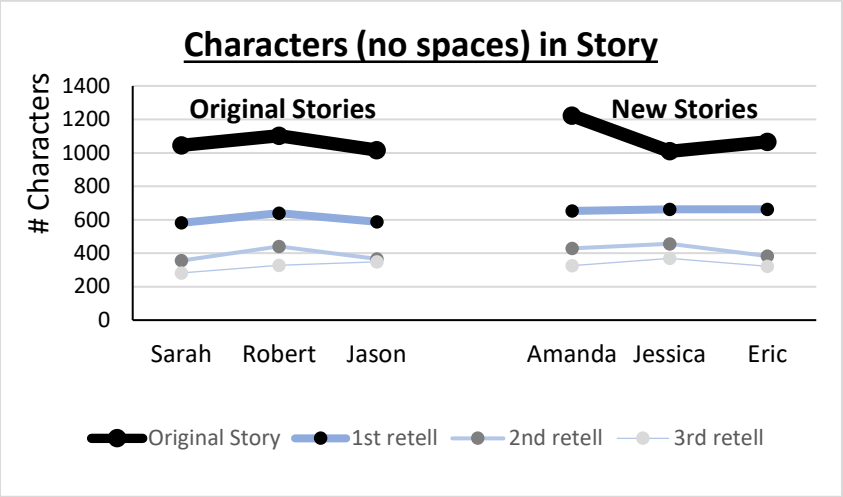
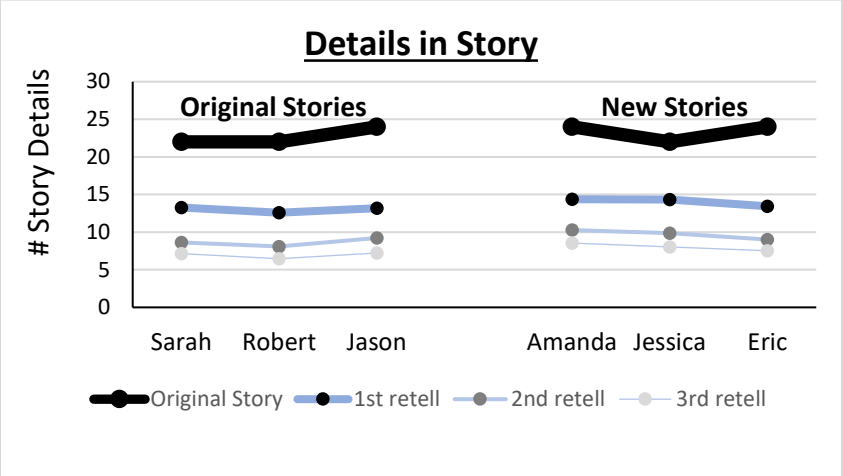
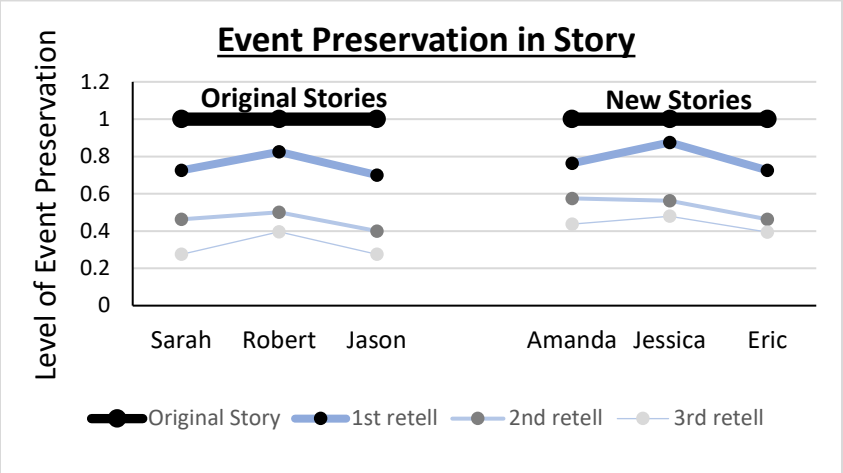
APPENDIX A: Telephone Game task and Pilot Data

FIGURE A1: Pilot data summary—similarity of original and novel stories

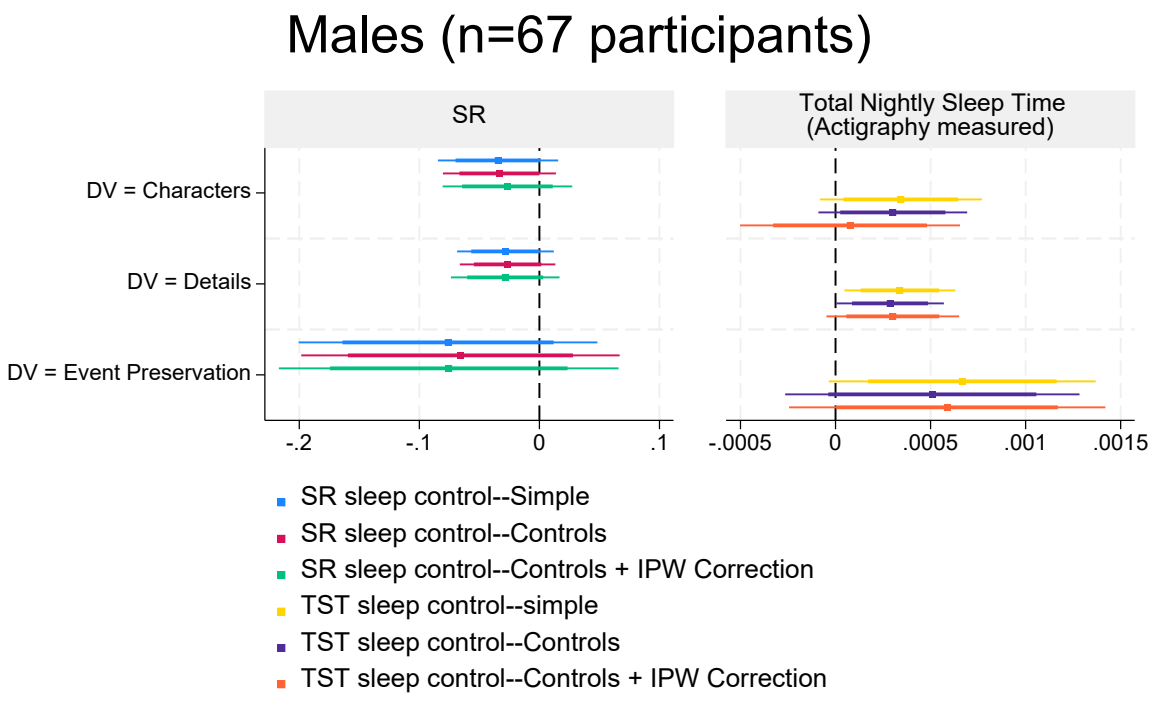


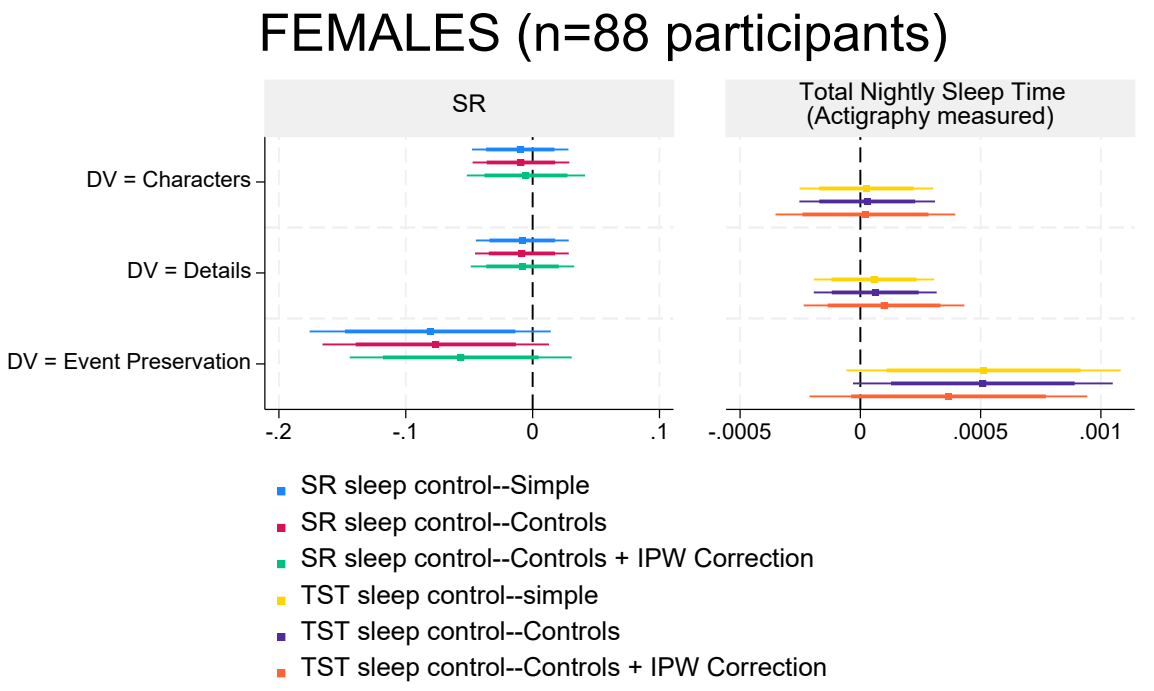




Notes: n=20 unique participants retold each of the 6 story retellings, the original stories (Breithaupt et al., 2018) and the newly created Amanda, Jessica and Eric Stories. Graphs represent average scored outcomes from 2 independent scorers of each retold story.

FIGURE A2: Analysis of individual effects by sex (compare to pooled results, main text Figure 2)





Notes: Plot shows the coefficient estimate with the 99% (thin line) and 95% (thick line) 1-tail test confidence interval on the preregistered hypothesis (for comparison with Figure 2 in main text).

Original Stories (details to score shaded, with key event in yellow)

Jason story (yellow highlight is key event resolution detail) (24)

- 1016 characters, 14 sentences, 24 details
  - Key problem: **lack of girlfriend/date**

Jason was a high school freshman. He was not very outgoing, did not do well in sports and was a big fan of science fiction TV programs. Near the beginning of the school year, he had an embarrassing moment playing football in gym class where the ball hit him in the head, causing his classmates to laugh at him and to tease him. By the middle of the semester, the school dance was coming up and all of Jason's classmates were excited about it, but it did not interest Jason. Later, his best friend found a date, and began pressuring Jason to go as well, telling him that it would be fun. But Jason still remembered being laughed at by his whole class and did not want to get turned down. Jason did not ask anyone out. He stayed at home during the dance and avoided talking to his best friend about it. A few weeks later, a girl, who was new to town, transferred into Jason's classes. Jason found her attractive and liked her more and more as time went on. But, he was too afraid to talk to her. One day, he decided that to overcome his fear of talking to her he needed to assume an alternate identity. He dressed up as a superhero and walked over to where she was sitting. He mumbled that she looked nice and asked her if she would like to eat lunch with him.

Sarah story (yellow highlight is key event resolution detail) (22)

- 1045 characters, 13 sentences, 22 details
  - Key problem: **Emotional inability to face Mom**.

Sarah was a teenager living in a small town in the American Midwest. She was a good student who did well in all of her classes, except history. Her mother wanted her to do better in history and hired a student from the local college as a tutor. On a day with exceptionally good weather, Sarah decided to spend her afternoon playing softball with her friends instead of attending her tutoring session. The tutor called Sarah's mother and told her about Sarah's absence that afternoon. The news embarrassed Sarah's mother, who scolded Sarah and lectured her on responsibility after she came home. Sarah did not think her skipping tutoring was a big deal since her mother did not have to pay for the missed lesson, she had good grades in all her other classes, and she knew that her tutor was laidback and would not take her absence personally. Sarah and her mother had a fight and Sarah ran out of the house. She decided to go into the woods near her house. In the woods, she made a fire and burnt everything her mother had ever given her. That made her feel better and gave her the confidence to talk to her mother again. Her mother had been waiting at home and was busying herself preparing dinner when Sarah got back. Upon seeing her mother in the kitchen, Sarah apologized.

Robert story (yellow highlight is key event resolution detail) (22)

- 1102 characters, 15 sentences, 22 details
    - Key problem: **Don't know exam answers**

Robert was a physics student attending a prestigious college on the East Coast. Even though he wanted to become a scientist, the college's requirements demanded that he take at least one history class. Robert decided to get the class out of the way in his freshman year. He enrolled in the only one available, an American history class with a professor who had a reputation of being stern but knowledgeable. Robert felt that the class was interesting enough and did well in the assignments and on the midterm exam. Unfortunately for Robert, the history final exam was scheduled on the same day as the final for an important physics class. The day before the exams, Robert stayed up half of the night, mostly studying physics. After taking the physics test in the morning he felt that he had done well. At noon he sat down in class to take his history exam. He knew the exam would be difficult, but he was shocked to see how hard it was. He may not have studied enough, but this exam was simply not fair and he started sweating. With an hour left, he asked for a bathroom break and left the room. In the bathroom, he did sprints in front of the stalls to get his brain going. While running, he hit his head on a door, but instead of confusing him, it seemed to cause everything to make sense. Then he returned to the testing room to complete the exam.

****

New Stories (details to score shaded, with key event in yellow)

Jessica story (yellow highlight is key event resolution detail) (22)

- 1009 characters, 16 sentences, 22 details
    - Key problem: **distress about vacation time off from work**

Jessica was married and had 2 children, and her husband was a blue-collar factory worker. Jessica had a part-time job at a local coffee shop. Jessica needed to ask for 2 weeks off from her job for a family vacation. She was concerned that her boss would not allow that. Her boss was rather mean at times, and complained once when Jessica needed to request one week off. Jessica feared that she may be fired if she asked for 2 weeks off from work, but her husband told her not to worry. Jessica wanted to catch her boss in a good mood before asking for the time off. One day, her boss seemed in a really good mood, and so Jessica asked for the 2 weeks off. Her boss suddenly became upset and told Jessica to choose between her job and her vacation. Her boss's reaction shocked Jessica. Even some customers in the coffee-shop seemed uncomfortable with such a reaction. Jessica dropped the topic and cried once she got home. Jessica's husband again told her to not worry, because just last week he found a box of money that was buried in the back yard. The box had enough money in it so that Jessica did not have to worry about her coffee shop job. That information made Jessica feel better. She had a really good night of sleep that evening.

Eric story (yellow highlight is key event resolution detail) (24)

- 1066 characters, 14 sentences, 24 details
    - Key problem: **Farm preventing Eric's piano dreams**

Eric was a teenager who grew up on the family farm. The farm had been in the family for several generations, Eric was an only child, and Eric was sure his father had planned on Eric taking over the farm one day. Eric enjoyed the farm, the animals, and working with his hands. However, he did not want the farm to become his life. Eric's family had a piano in their house, and he spent many hours since childhood teaching himself how to play. Playing the piano seemed to come naturally to him. Eric was gifted at the piano, and he hoped to study music one day at a University. The summer before Eric's senior year in high school, Eric's father had a major heart attack and died. Eric's whole family was devastated, and his dreams of studying music seemed to fade away as he was needed to help his mother on the farm in a full-time capacity. After a few weeks, Eric's mother shared a letter written for Eric from his father. The letter told Eric that he and his mother saw Eric's music talent and had saved enough money for him to go to college and pursue his dreams. Arrangements had been made to have Eric's cousin help with the farm until it could be sold. Eric's mother was ready to move on from farm life as well after her husband's death. Eric went to college and eventually became a professional pianist.

Amanda story (yellow highlight is key event resolution detail) (24)

- 1222 characters, 15 sentences, 24 details
    - Key problem: **Concern over controlling new employee**

Amanda was a timid woman in her 20's. She lived in a big city where life was fast-paced, but she loved to spend time in the mountains. Amanda had a pet cat in her studio apartment, and her social time was often spent with friends from her job at an insurance company. Her friends were also somewhat timid, and certainly would not be considered risk-takers. One day, the insurance company hired a new employee. After a few weeks, it became clear that this new employee had a leadership personality and was also a thrill-seeker. The new employee was an avid rock-climber, scuba-diver, and had gone sky-diving several times. Stories of this new employee's adventures amazed Amanda's timid friends. The new employee invited Amanda and her friends to go hiking at a place a couple hours from the city one weekend. Amanda was conflicted because her friends wanted to go, but she knew the hike location was dangerous due to high cliffs in that area. Amanda's co-workers seemed hypnotized by this new employee's charismatic personality. Sensing Amanda's resistance, the new employee threatened to start a rumor that would get Amanda fired if she did not go on the hiking trip. Unfortunately for the new employee, this threat was caught on the company's security camera. After Amanda shared this with her boss, the new employee was fired, and Amanda's friends then realized they had been deceived. Afterwards, Amanda enjoyed a weekend hike with her friends at a safer location.

TELEPHONE GAME TASK INSTRUCTIONS

R-E-Ja story block instructions

(dotted lines show page breaks in survey. Stories presented in randomized order)

Please input your experiment subject code (e.g., SRWR113, WRSR18, etc), *not your name,* in the space below.
(should be 4 letters followed by 1-3 numbers)

Please mark the number that best corresponds to how sleepy you feel right now. You may mark any number, but mark only one number.

- ○ 1. Extremely alert
- ○ 2.
- ○ 3. Alert
- ○ 4.
- ○ 5. Neither alert nor sleepy
- ○ 6.
- ○ 7. Sleepy - but no difficulty remaining awake
- ○ 8.
- ○ 9. Extremely sleepy - fighting sleep

We are interested in understanding the impact of sleep on how people communicate with one another. In this study, we will show you a piece of text someone has written and give you time to read it.
Your task will be to read the text and try to recall as much of this information to the best of your ability. You will do this by rewriting the story in your own words and then answering some relevant questions.
It is important that you understand the text, but please do not copy the story, take a picture of it, or use any assistance in doing this task. The task should take no more than 15-20 minutes to complete.

Please begin.

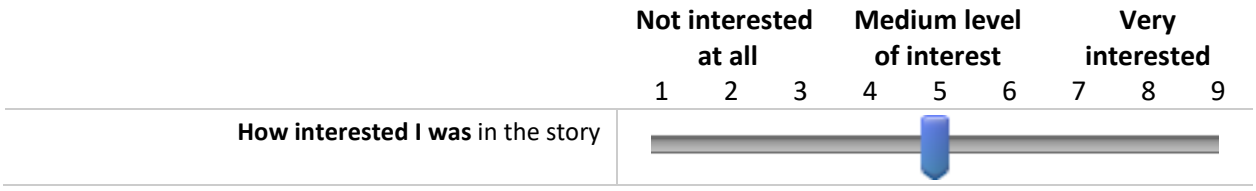
Please spend sufficient time to fully read the following story. You will be asked to retell the story on a following screen.

"Robert was a physics student attending a prestigious college on the East Coast. Even though he wanted to become a scientist, the college's requirements demanded that he take at least one history class. Robert decided to get the class out of the way in his freshman year. He enrolled in the only one available, an American history class with a professor who had a reputation of being stern but knowledgeable. Robert felt that the class was interesting enough and did well in the assignments and on the midterm exam. Unfortunately for Robert, the history final exam was scheduled on the same day as the final for an important physics class. The day before the exams, Robert stayed up half of the night, mostly studying physics. After taking the physics test in the morning he felt that he had done well. At noon he sat down in class to take his history exam. He knew the exam would be difficult, but he was shocked to see how hard it was. He may not have studied enough, but this exam was simply not fair and he started sweating. With an hour left, he asked for a bathroom break and left the room. In the bathroom, he did sprints in front of the stalls to get his brain going. While running, he hit his head on a door, but instead of confusing him, it seemed to cause everything to make sense. Then he returned to the testing room to complete the exam."

Please retell the story you just read on the previous page by typing the story into the text box below. Please attempt to retell the story as accurately as possible.

[TEXT BOX HERE]

Please tell us how <u>interested</u> you were in the story you just retold using the scale below.



Please tell us how surprised you were in the story you just retold using the scale below.

	Not surprised at all / Medium level of surprise / Very surprised 1 2 3 4 5 6 7 8 9
How surprised I was in the story	

Please spend sufficient time to fully read the following story. You will be asked to retell the story on a following screen.

"Eric was a teenager who grew up on the family farm. The farm had been in the family for several generations, Eric was an only child, and Eric was sure his father had planned on Eric taking over the farm one day. Eric enjoyed the farm, the animals, and working with his hands. However, he did not want the farm to become his life. Eric's family had a piano in their house, and he spent many hours since childhood teaching himself how to play. Playing the piano seemed to come naturally to him. Eric was gifted at the piano, and he hoped to study music one day at a University. The summer before Eric's senior year in high school, Eric's father had a major heart attack and died. Eric's whole family was devastated, and his dreams of studying music seemed to fade away as he was needed to help his mother on the farm in a full-time capacity. After a few weeks, Eric's mother shared a letter written for Eric from his father. The letter told Eric that he and his mother saw Eric's music talent and had saved enough money for him to go to college and pursue his dreams. Arrangements had been made to have Eric's cousin help with the farm until it could be sold. Eric's mother was ready to move on from farm life as well after her husband's death. Eric went to college and eventually became a professional pianist."

Please retell the story you just read on the previous page by typing the story into the text box below. Please attempt to retell the story as accurately as possible.

[TEXT BOX HERE]

Please tell us how interested you were in the story you just retold using the scale below.

	Not interested at all / Medium level of interest / Very interested 1 2 3 4 5 6 7 8 9
How interested I was in the story	

Please tell us how surprised you were in the story you just retold using the scale below.

	Not surprised at all / Medium level of surprise / Very surprised 1 2 3 4 5 6 7 8 9
How surprised I was in the story	

Please spend sufficient time to fully read the following story. You will be asked to retell the story on a following screen.

"Jessica was married and had 2 children, and her husband was a blue-collar factory worker. Jessica had a part-time job at a local coffee shop. Jessica needed to ask for 2 weeks off from her job for a family vacation. She was concerned that her boss would not allow that. Her boss was rather mean at times, and complained once when Jessica needed to request one week off. Jessica feared that she may be fired if she asked for 2 weeks off from work, but her husband told her not to worry. Jessica wanted to catch her boss in a good mood before asking for the time off. One day, her boss seemed in a really good mood, and so Jessica asked for the 2 weeks off. Her boss suddenly became upset and told Jessica to choose between her job and her vacation. Her boss's reaction shocked Jessica. Even some customers in the coffee-shop seemed uncomfortable with such a reaction. Jessica dropped the topic and cried once she got home. Jessica's husband again told her to not worry, because just last week he found a box of money that was buried in the back yard. The box had enough money in it so that Jessica did not have to worry about her coffee shop job. That information made Jessica feel better. She had a really good night of sleep that evening."

Please retell the story you just read on the previous page by typing the story into the text box below. Please attempt to retell the story as accurately as possible.

[TEXT BOX HERE]

Please tell us how interested you were in the story you just retold using the scale below.

	Not interested at all / Medium level of interest / Very interested 1 2 3 4 5 6 7 8 9
How interested I was in the story	

Please tell us how surprised you were in the story you just retold using the scale below.

	Not surprised at all 1 2 3	**Medium level of surprise** 4 5 6	**Very surprised** 7 8 9
How surprised I was in the story			

APPENDIX B: Additional estimation results

TABLE B1: Surprise and Interest across retells

VARIABLES	(1) DV= Surprise	(2) DV= Interest	(3) DV= Surprise	(4) DV= Interest
SR (=1)	-0.50**	-0.44**	-0.04	-0.29
	(0.15)	(0.13)	(0.28)	(0.27)
Retell2 (=1)	0.22	0.37	0.36	0.46
	(0.28)	(0.27)	(0.32)	(0.31)
Retell3 (=1)	-0.50*	-0.38	-0.24	-0.32
	(0.25)	(0.24)	(0.28)	(0.28)
Retell2 * SR	---	---	-0.44	-0.26
			(0.38)	(0.35)
Retell3 * SR	---	---	-0.72*	-0.17
			(0.36)	(0.34)
Age	-0.00	0.01	-0.00	0.01
	(0.05)	(0.04)	(0.05)	(0.05)
Female (=1)	0.42	0.50*	0.43	0.50*
	(0.23)	(0.23)	(0.22)	(0.23)
Minority (=1)	0.40	0.87**	0.41	0.87**
	(0.30)	(0.30)	(0.30)	(0.30)
MEQ	0.03	0.02	0.03	0.02
	(0.03)	(0.03)	(0.03)	(0.03)
CRTscore	0.07	-0.04	0.07	-0.04
	(0.06)	(0.06)	(0.06)	(0.06)
Repeat Admin (=1)	-0.32*	-0.48**	-0.31*	-0.47**
	(0.13)	(0.12)	(0.13)	(0.12)
Constant	4.42**	3.72**	4.27**	3.65**
	(1.09)	(1.03)	(1.13)	(1.04)
Observations	929	929	929	929
# Participants	155	155	155	155
Story Fixed Effects	YES	YES	YES	YES
R-squared	0.108	0.121	0.114	0.120
X^2 Test of Retell2 = Retell3	7.44**	7.89**	4.16*	6.60**
X^2 Test of Retell2 = Retell2*SR = 0	---	---	0.04	0.35
X^2 Test of Retell3 + Retell3*SR = 0	---	---	8.55**	2.47

Notes: ** p<0.01, * p<0.05 for the 1-tailed (preregistered) test. Robust standard errors in parentheses.

TABLE B2: The impact of SR on Characters preserved

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
SR (=1)	-0.02	-0.02	-0.01			
	(0.01)	(0.01)	(0.02)			
Avg Nightly Sleep (min)				0.00	0.00	0.00
				(0.00)	(0.00)	(0.00)
Age		0.01**	0.01**		0.01**	0.01**
		(0.00)	(0.00)		(0.00)	(0.00)
Female (=1)		0.08**	0.09**		0.08**	0.09**
		(0.03)	(0.03)		(0.03)	(0.03)
Minority (=1)		0.02	0.02		0.02	0.02
		(0.04)	(0.04)		(0.04)	(0.04)
MEQ		0.01**	0.01**		0.01**	0.01**
		(0.00)	(0.00)		(0.00)	(0.00)
CRTscore		0.02**	0.02**		0.02**	0.02**
		(0.01)	(0.01)		(0.01)	(0.01)
Repeat Administration (=1)		0.01	0.01		0.01	0.01
		(0.01)	(0.01)		(0.01)	(0.01)
Constant	-0.25**	-0.75**	-0.75**	-0.32**	-0.80**	-0.77**
	(0.01)	(0.08)	(0.09)	(0.05)	(0.09)	(0.10)
IPW Correction	NO	NO	YES	NO	NO	YES
Story Fixed Effects	YES	YES	YES	YES	YES	YES
Observations	924	924	924	924	924	924
# Participants	155	155	155	155	155	155
R-squared	0.00165	0.118	0.12	0.00492	0.117	0.12

*p < .05, **p < .01 for the 1-tailed test of the preregistered hypothesis tests on the SR or Avg Nightly Sleep Variables (all other significance based on 2-tailed tests). Random effects GLS regressions with robust standard errors (in parenthesis) clustered on participant. IPW corrected regressions are linear ordinary least squares regressions (weights based on selection equation results shown in Table B5).

TABLE B3: The impact of SR on Details preserved

VARIABLES	(1) DETpreserve	(2) DETpreserve	(3) DETpreserve	(4) DETpreserve	(5) DETpreserve	(6) DETpreserve
SR (=1)	-0.02	-0.02	-0.02			
	(0.01)	(0.01)	(0.01)			
Avg Nightly Sleep (min)				0.0002*	0.000015*	0.0002*
				(0.0001)	(0.00008)	(0.0001)
Age		0.01**	0.01**		0.01**	0.01**
		(0.00)	(0.00)		(0.00)	(0.00)
Female (=1)		0.10**	0.11**		0.10**	0.10**
		(0.02)	(0.02)		(0.02)	(0.02)
Minority (=1)		0.02	0.02		0.02	0.02
		(0.03)	(0.03)		(0.03)	(0.03)
MEQ		0.01	0.01		0.01	0.01
		(0.00)	(0.00)		(0.00)	(0.00)
CRTscore		0.02**	0.02**		0.02**	0.02**
		(0.01)	(0.01)		(0.01)	(0.01)
Repeat Administration (=1)		0.01	0.01		0.01	0.01
		(0.01)	(0.01)		(0.01)	(0.01)
Constant	-0.23**	-0.62**	-0.63**	-0.31**	-0.68**	-0.70**
	(0.01)	(0.08)	(0.08)	(0.04)	(0.08)	(0.09)
Story Fixed Effects	YES	YES	YES	YES	YES	YES
IPW CORRECTION	NO	NO	YES	NO	NO	YES
Observations	924	924	924	924	924	924
# Participants	155	155	155	155	155	155
R-squared	0.00295	0.121	0.13	0.0176	0.124	0.13

*p < .05, **p < .01 for the 1-tailed test of the preregistered hypothesis tests on the SR or Avg Nightly Sleep Variables (all other significance based on 2-tailed tests). Random effects GLS regressions with robust standard errors (in parenthesis) clustered on participant. IPW corrected regressions are linear ordinary least squares regressions (weights based on selection equation results shown in Table B5).

TABLE B4: The impact of SR on Key Event Preservation

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	EPpreserve	EPpreserve	EPpreserve	EPpreserve	EPpreserve	EPpreserve
SR (=1)	-0.07*	-0.07*	-0.07*			
	(0.03)	(0.03)	(0.03)			
Avg Nightly Sleep (min)				0.0006**	0.0005**	0.0005*
				(0.0002)	(0.0002)	(0.0002)
Age		0.00	0.00		0.00	0.00
		(0.01)	(0.01)		(0.01)	(0.01)
Female (=1)		0.09*	0.09*		0.08	0.08
		(0.04)	(0.04)		(0.04)	(0.04)
Minority (=1)		0.06	0.06		0.06	0.06
		(0.06)	(0.06)		(0.07)	(0.06)
MEQ		0.00	0.00		0.00	-0.00
		(0.01)	(0.01)		(0.01)	(0.01)
CRTscore		0.02	0.02		0.01	0.01
		(0.01)	(0.01)		(0.01)	(0.01)
Repeat Administration (=1)		-0.04	-0.04		-0.04	-0.04
		(0.04)	(0.04)		(0.04)	(0.04)
Constant	-0.12**	-0.31	-0.30	-0.38**	-0.50**	-0.49**
	(0.02)	(0.16)	(0.16)	(0.08)	(0.16)	(0.16)
# Participants	155	155	155	155	155	155
R-squared	0.00423	0.0212	0.02	0.00650	0.0213	0.02
Story Fixed Effects	YES	YES	YES	YES	YES	YES
IPW CORRECTION	NO	NO	YES	NO	NO	YES
Observations	851	851	851	851	851	851

*p < .05, **p < .01 for the 1-tailed test of the preregistered hypothesis tests on the SR or Avg Nightly Sleep Variables (all other significance based on 2-tailed tests). Random effects GLS regressions with robust standard errors (in parenthesis) clustered on participant. IPW corrected regressions are linear ordinary least squares regressions (weights based on selection equation results shown in Table B5).

TABLE B5: Selection Equation Probit Results

Dep Var = 1 if completing the protocol conditional on enrollment

VARIABLES	(1) coefficient	(2) st. error
Female	0.30	(0.30)
Race	-0.08	(0.41)
Age	0.06	(0.07)
LWselfTST	-0.14	(0.18)
LNselfTST	-0.02	(0.11)
OptSleep	0.24	(0.16)
Depression	-0.12	(0.16)
Anxiety	0.02	(0.06)
Epworth	-0.12	(0.05)**
MEQ	0.02	(0.05)
control	0.58	(0.42)
Constant	0.27	(2.76)
Observations	175	
Chi-squared	15.30	
Pseudo-Rsquared	0.123	

Standard errors in parentheses
** p<0.01, * p<0.05

Notes: n=176 participants enrolled in the study
while 155 completed the study.
One participant was omitted due to incomplete data from online screening survey.
A *Race* categories variable used in place of indicator for *Minority* (= 1 if Hispanic and/or non-Caucasian)
perfectly predicts completing the protocol--i.e.
the few minority participants all completed the study

TABLE B6: The impact of SR on Characters by level of affective engagement

Dep Variable: *CHARACTERS* preserved in retell (relative to source story)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Lower Surprise	High Surprise	Lower Interest	High Interest	Lower Surprise	High Surprise	Lower Interest	High Interest
SR (=1)	-0.01	-0.02	-0.02	0.04	---	---	---	---
	(0.01)	(0.04)	(0.01)	(0.06)				
Avg Nightly Sleep (min)	---	---	---	---	0.000	-0.000	0.000	-0.000
					(0.000)	(0.000)	(0.000)	(0.000)
Age	0.01**	0.01*	0.01**	0.03*	0.01**	0.01*	0.01**	0.03*
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)
Female (=1)	0.07*	0.11**	0.08**	0.15**	0.07*	0.11**	0.07*	0.15**
	(0.03)	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)	(0.03)	(0.05)
Minority (=1)	0.02	0.01	0.01	-0.03	0.02	0.01	0.01	-0.03
	(0.04)	(0.05)	(0.04)	(0.06)	(0.04)	(0.04)	(0.04)	(0.06)
MEQ	0.01**	0.00	0.01**	0.01	0.01**	0.00	0.01**	0.01
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)
CRTscore	0.02**	0.02*	0.02**	0.01	0.02**	0.02*	0.02**	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Repeat Administration (=1)	0.01	-0.02	0.00	0.02	0.01	-0.02	0.00	0.02
	(0.01)	(0.03)	(0.01)	(0.06)	(0.01)	(0.03)	(0.01)	(0.06)
Constant	-0.78**	-0.63**	-0.75**	-1.00**	-0.80**	-0.59**	-0.81**	-0.79*
	(0.08)	(0.13)	(0.09)	(0.28)	(0.09)	(0.14)	(0.09)	(0.36)
Story Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	766	158	845	79	766	158	845	79
# Participants	155	86	153	46	155	86	153	46
R-squared	0.121	0.171	0.116	0.264	0.121	0.183	0.114	0.269

*p < .05, **p < .01 for the 2-tailed test of the exploratory hypotheses. Random effects GLS regressions with robust standard errors (in parenthesis) clustered on participant.

TABLE B7: The impact of SR on Details by level of affective engagement

Dep Variable: *DETAILS* preserved in retell (relative to source story)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Lower Surprise	High Surprise	Lower Interest	High Interest	Lower Surprise	High Surprise	Lower Interest	High Interest
SR (=1)	-0.01	0.005	-0.02	0.07	---	---	---	---
	(0.01)	(0.03)	(0.01)	(0.05)				
Avg Nightly Sleep (min)	---	---	---	---	0.0001	-0.0001	0.0002*	-0.0005
					(0.0001)	(0.0002)	(0.0001)	(0.0003)
Age	0.01**	0.01	0.01**	0.03*	0.01**	0.01	0.01**	0.02*
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
Female (=1)	0.10**	0.10**	0.10**	0.13**	0.10**	0.10**	0.09**	0.14**
	(0.02)	(0.03)	(0.02)	(0.04)	(0.02)	(0.03)	(0.02)	(0.04)
Minority (=1)	0.01	0.03	0.01	-0.00	0.01	0.03	0.01	-0.01
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)
MEQ	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
CRTscore	0.02**	0.03**	0.02**	0.02*	0.02**	0.03**	0.02**	0.02*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Repeat Administration (=1)	0.02	-0.01	0.01	0.03	0.02	-0.01	0.01	0.03
	(0.01)	(0.02)	(0.01)	(0.05)	(0.01)	(0.02)	(0.01)	(0.05)
Constant	-0.64**	-0.50**	-0.63**	-0.86**	-0.69**	-0.44**	-0.70**	-0.57*
	(0.08)	(0.10)	(0.08)	(0.20)	(0.09)	(0.10)	(0.08)	(0.29)
Story Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	766	158	845	79	766	158	845	79
# Participants	155	86	153	46	155	86	153	46
R-squared	0.112	0.235	0.118	0.327	0.116	0.251	0.122	0.336

*p < .05, **p < .01 for the 2-tailed test of the exploratory hypotheses. Random effects GLS regressions with robust standard errors (in parenthesis) clustered on participant.

TABLE B8: The impact of SR on Event Preservation by level of affective engagement

Dep Variable: *EVENT PRESERVATION* maintained in retell (relative to source story)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Lower Surprise	High Surprise	Lower Interest	High Interest	Lower Surprise	High Surprise	Lower Interest	High Interest
SR (=1)	-0.08*	0.04	-0.07*	0.07	---	---	---	---
	(0.04)	(0.07)	(0.03)	(0.16)				
Avg Nightly Sleep (min)	---	---	---	---	0.001**	-0.000	0.001**	-0.001
					(0.0002)	(0.000)	(0.0002)	(0.001)
Age	0.01	-0.00	0.00	0.05*	0.01	-0.00	0.00	0.04*
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
Female (=1)	0.09	0.12	0.10*	0.04	0.08	0.12	0.09*	0.06
	(0.05)	(0.07)	(0.05)	(0.06)	(0.05)	(0.07)	(0.05)	(0.06)
Minority (=1)	0.04	0.16	0.09	-0.06	0.05	0.16	0.09	-0.06
	(0.07)	(0.11)	(0.07)	(0.07)	(0.07)	(0.11)	(0.07)	(0.07)
MEQ	-0.00	0.01	0.00	0.00	-0.00	0.01	-0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
CRTscore	0.02	0.02	0.02	-0.02	0.01	0.02	0.02	-0.02
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)
Repeat Administration (=1)	-0.03	-0.10	-0.05	0.05	-0.03	-0.10	-0.05	0.05
	(0.04)	(0.07)	(0.04)	(0.16)	(0.04)	(0.07)	(0.04)	(0.15)
Constant	-0.34	-0.32	-0.29	-1.06**	-0.56**	-0.19	-0.50**	-0.73
	(0.18)	(0.24)	(0.17)	(0.34)	(0.17)	(0.30)	(0.17)	(0.46)
Story Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	698	153	776	75	698	153	776	75
# Participants	155	84	153	45	155	84	153	45
R-Squared	0.0205	0.109	0.0268	0.108	0.0214	0.110	0.0272	0.112

*p < .05, **p < .01 for the 2-tailed test of the exploratory hypotheses. Random effects GLS regressions with robust standard errors (in parenthesis) clustered on participant.