A test of the somnolent mentation theory and the cognitive shuffle insomnia treatment

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Abstract

Insomnia affects about 33% of Americans according to Harvey & Tang (2003) who called for new cognitive treatments. We will report preliminary results from a test of (a) the Somnolent Mentation theory (SMT) of sleep onset (SO) and (b) a new cognitive treatment for insomnia, the cognitive shuffle (CS), derived from the SMT (Beaudoin, 2013, 2014). According to SMT, incoherent mentation characteristic of SO is not merely a side-effect of the SO period but promotes it, meaning it is somnolent. The SMT identifies several types of insomnolent mentation, which involve sense making (e.g., problem solving). SMT postulates counter-insomnolent mentation, thought patterns that interfere with insomnolent mentation. The CS is predicted to be both somnolent and counter-insomnolent (super-somnolent). Participants either engage in constructive worry Carney & Waters (2006) or in the CS using SomnoTest an iOS app developed by CogSci Apps Corp. (led by Beaudoin) based on mySleepButton®.

References (for abstract and poster)

Beaudoin, L. P. (2013). The possibility of super-somnolent mentation: A new information-processing approach to sleep-onset acceleration and insomnia exemplified by serial diverse imagining. Cognitive Productivity Research Project, Simon Fraser University. http://summit.sfu.ca/item/12143

Beaudoin, L. P. (2014a, July). *A design-based approach to sleep-onset and insomnia: super-somnolent mentation, the cognitive shuffle and serial diverse imagining*. Paper presented at the 36th Annual Conference of the Cognitive Science Society's workshop on "Computational Modeling of Cognition-Emotion Interactions: Relevance to Mechanisms of Affective Disorders and Therapeutic Action", Québec, Canada.

Beaudoin, L. P. & Digdon, N. (2015) Towards an affective information-processing theory of sleep-onset and insomnia. Manuscript in preparation.

Brown, R. E., Basheer, R., McKenna, J. T., Strecker, R. E., & McCarley, R. W. (2012). Control of sleep and wakefulness. *Physiological Reviews, 92*(3), 1087–1187.

Carney, C.E., & Waters, W.F. (2006). Effects of a structured problem-solving procedure on pre-sleep cognitive arousal in college students with insomnia. *Behavioral Sleep Medicine, 4*, 13–28.

Dennett, D. C. (1971). Intentional systems. *The Journal of Philosophy, 68*(4), 87-106.

Digdon, N., & Koble, A. (2011). Effects of constructive worry, imagery distraction, and gratitude interventions on sleep quality: A pilot trial. *Applied Psychology: Health and Well-Being, 3*(2), 193–206. http://doi.org/10.1111/j.1758-0854.2011.01049.x

Harvey, A. G., Tang, N. K. Y., & Browning, L. (2005). Cognitive approaches to insomnia. *Clinical Psychology Review, 25*(5), 593–611. doi:10.1016/j.cpr.2005.04.005

Kräuchi, K., & DeBoer, T. (2011). Body temperature, sleep, and hibernation. In M. H. Kryger, T. Roth, & W. C. Dement, *Principles and Practice of Sleep Medicine* (pp. 323–334). Elsevier: St. Louis.

Saper, C. B., Fuller, P. M., Pedersen, N. P., Lu, J., & Scammell, T. E. (2010). Sleep state switching. *Neuron, 68*(6), 1023–1042.

Sloman, A. (1993). Prospects for AI as the general science of intelligence. In A. Sloman, D. Hogg, G. Humphreys, D. Partridge, & A. Ramsay (Eds.). *Prospects for Artificial Intelligence,* (pp. 1–10). Amsterdam, Netherlands: IOS Press.

Wuyts, J., De Valck, E., Vandekerckhove, M., Pattyn, N., Bulckaert, A., Berckmans, D., et al. (2012). The influence of pre-sleep cognitive arousal on sleep onset processes. *International Journal of Psychophysiology, 83*(1), 8–15. http://doi.org/10.1016/j.ijpsycho.2011.09.016

Revision history

2015-08-01. Replaced VTA with ascending reticular activating system.

Poster (A0 Size paper, below).

A Test of the Somnolent Mentation Theory and the Cognitive Shuffle Insomnia Treatment

By Nancy Digdon (MacEwan University) and Luc P. Beaudoin (Simon Fraser University)*

I. Somnolent Mentation Theory and the Sleep Onset Control System

There are several cognitive theories of insomnia (cf. Harvey, or Espie), but Beaudoin's (2013, 2014) Somnolent Mentation Theory (SMT) is the first to adopt a designer stance to reverse engineer mental processes involved in falling asleep. This means specifying the requirements and exploring designs to address these requirements (Dennett, 1971; Sloman, 1993). Although other cognitive insomnia research assumes that mental processes prior to sleep affect sleep onset latency, it lacks consistent, concise, theoretically neutral terminology, and more generally a taxonomy of these effects. SMT addresses this gap. The expression, 'cognitive arousal' (Wuyts et al, 2012), which is widely, but inconsistently, used in the insomnia literature contributes to theoretical confusion. None of the papers that cite 'cognitive arousal' as a cause of insomnia actually invoke a theory from which to predict how cognitively arousing a given mental activity is. What is it that makes some mental activity interfere with sleep, and other equally demanding mental activity not do so? Can some very demanding mental activities promote sleep? SMT provides a taxonomy of mentation to replace talk of 'cognitive arousal'.

The taxonomy recognizes that the sleep onset process is affected by many factors and presumably unaffected by others. The taxonomy outlines five possible categories of mentation: 1) Asomnolent mentation, which has no systematic effect on sleep onset; 2) Insomnolent mentation, which delays sleep onset; 3.) Counter-insomnolent mentation, which is deliberate mention that replaces counter-insomnolent mentation; and 4) Pro-somnolent mentation, which hastens sleep onset; and 5) Super-somnolent mentation, which is both counter-insomnolent and pro-somnolent. Although the taxonomy was developed within SMT, it can be used in a theoretically neutral way to frame the broader psychological literature.

The sleep onset control system (SOCS) is an evolutionary ancient mechanism, integral to the sleep state switching system (Brown et al., 2012, Saper et al, 2010), that promotes sleep based on multiple factors, including a determination of when it is safe to sleep. It includes old brain structures such as the ascending reticular activating system and preoptic area. The SOCS's reactions to physiological inputs such as homeostatic sleep drive, circadian rhythms, light, and temperature (Krauchi & DeBoer 2000) have been researched more than its psychological inputs. SMT outlines four postulates concerning mentation and SOCS: The rationale for these postulates can be found in Beaudoin (2014) and Beaudoin & Digdon (2015).

Postulate 1 (P1): A decline in situational awareness, or sense making, including active, globally coherent mentation, is not merely a consequence of impending sleep, but is pro-somnolent.

Postulate 2 (P2): Energy and tension are insomnolent.

Postulate 3 (P3): Alarms (primary emotions) are insomnolent.

Postulate 4 (P4): States of perturbance (tertiary emotions), in which insistent motivators tend to disrupt and maintain attention, are insomnolent.

II. New Cognitive Shuffle Insomnia Treatment: Serial Diverse Imagining

Imagery distraction is a validated treatment for insomnia but has weaknesses that serial diverse imagining (SDI, a form of cognitive shuffle) aims to overcome. SDI is used while lying in bed ready to sleep. SomnoTest (an iOS app based on mySleepButton®), facilitates SDI with audio recording of pseudo-randomly presented concrete words presented one at a time every 8 seconds (by default). After hearing the word, the person constructs a mental image of it until they replace it with an image of the next spoken word, and so on. The app has a built in timer so that the person can set a time for the app to shut off automatically. This is meant to facilitate sleep onset via each postulate. P1: it induces globally incoherent mentation, which is pro-somnolent. P2: it is cognitively demanding, which induces fatigue. P3: it interferes with the ability to generate information in working memory which may trigger or sustain alarms, meaning it is counter-insomnolent. P4: by being engaging, it reduces the amount of resources available for processing other motivators (and hence for ruminating), which means it may decrease the latter's insistence; it may also raise attention/interrupt filter thresholds (Beaudoin, 1994; Sloman, 1987); hence SDI may decrease perturbance, making it counter-insomnolent in this respect as well. Hence SDI is expected to be super-somnolent.

III. Pilot Test of the Cognitive Shuffle (called SomnoTest App) Compared to an Alternative Empirically Validated Treatment

64 MacEwan students (59 females, 5 males; Mean age = 19.78, SD= 2.07) were randomly assigned to 1 of 3 intervention groups: 1) SomnoTest app; 2) Constructive Worry (validated by Carney & Waters, 2006), or 3) Combined interventions. The study had a longitudinal design from pre-intervention to one month post-intervention. Data collection is still ongoing, but preliminary results are promising. All intervention groups showed improvement after 1 week of doing the intervention.

Preliminary Results

Measure	Group	Pretest M (SD)	Post-test M (SD)	F
Cognitive Pre-sleep Arousal	Structured Problem Solving (n=15)	25.80 (4.52)	12.27 (6.78)	134.51***
	SomnoTest App (n=17)	27.59 (6.51)	15.88 (8.34)	
	Combined Interventions (n= 10)	25.40 (7.00)	13.00 (7.63)	
Somatic Pre-sleep Arousal	Structured Problem Solving (n=15)	16.00 (4.46)	8.07 (6.80)	80.94***
	SomnoTest App (n=17)	14.59 (4.65)	6.71 (5.85)	
	Combined Interventions (n=10)	14.20 (3.71)	5.90 (6.40)	
Glasgow Sleep Effort Scale	Structured Problem Solving (n=15)	5.87 (2.48)	5.47 (2.97)	6.44*
	SomnoTest App (n=17)	6.88 (2.97)	4.88 (3.22)	
	Combined Interventions (n=10)	6.20 (3.05)	4.90 (2.77)	

We found no significant group differences or interaction effects, but these may emerge in our final sample size of 30-40 per group and the increased statistical power. Of interest, 78% of students who received both interventions rated the SomnoTest App as more helpful, 11% rated Structured Problem Solving as more helpful, and 11 % rated interventions as equally helpful. Several participants reported the app helped distract them from thinking about their concerns.

IV Conclusion

Preliminary results suggest that SDI is at least as effective as Constructive Worry and may be perceived as more effective.
There are several avenues for future research:

- compare SDI with other methods that also use an app.
- compare a self-directed (non-app) version of SDI (available in Beaudoin, 2013) with traditional imagery distraction and other deliberate mentation strategies.
- measure the effects of SDI on tension, stress (alarms), and perturbance;
- vary and measure the effects of aspects of the speech presented to participants in the SDI condition (parts of speech, more or less abstract words, using scenes, motion vs. non-motion concepts, mental drawing, etc.)
- explore the possibility of a modulating role of need for cognition, stress levels, and other personal variables on the effects of SDI on sleep measures.

References and further information can be obtained online from
http://www.sfu.ca/~lpb/insomnia/sdi-constructive-worry
Email: DigdonN@macewan.ca or lpb@sfu.ca

Disclosure. Luc P. Beaudoin is a director and shareholder of CogSci Apps Corp. which develops mySleepButton and SomnoTest. He is also the owner of CogZest, which provides training in insomnia and cognitive productivity.