UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

The Effects of Lighting Colour and Intensity on Students' Perceptions of Comfort Within Nap Pods

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Executive Summary

Nap pods within the university environment are becoming increasingly popular with the intention of providing students an opportunity for rest. However, in order to design optimal nap pods, it is important to analyze the many factors that contribute to the design process, including light, sound, temperature, and aroma. In this study, we chose to explore the effects of lighting colour and intensity on perceptions of comfort in nap pods, with the aim of finding which lighting colours and intensities students would associate with feelings of calmness and sleepiness, and which would be associated with feelings of alertness and wakefulness. This was done through the administration of a survey in which participants rated their feelings of calmness, sleepiness, alertness, and wakefulness after seeing an image of a nap pod in different lighting colour hues and intensity. We found that overall, cool colours with a blueish hue and dim and moderate intensities of brightness were preferred by participants.

Keywords: lighting colour, lighting intensity, perception, comfort, napping, nap pods

Introduction

The napping environment holds great importance when it comes to an individual's sleep quality, especially in the context of light colour hues and intensity. There are several studies that highlight and look into these effects when it comes to sleeping quality. Although there is a limited amount of literature that looks into *preferred* lighting colour and intensity under napping conditions, a significant amount of research has been done to explore what kind of lighting conditions are most optimal and healthy within the sleeping environment, more specifically, in regards to blue light and dimness. Research by Joshua J. Gooley, Kyle Chamberlain, Kurt A. Smith, Sat Bir S. Khalsa, et al., (2011) looked at the effects of light intensities on sleep by comparing dim light conditions to bright light conditions. They found that exposure to bright light compared to dim light before sleep, greatly suppressed melatonin, resulting in a later melatonin onset in 99% of the participants and shortening its duration by 90 minutes, making it more and more difficult to fall asleep. Joshua J. Gooley, Kyle Chamberlain, Kurt A. Smith, Sat Bir S. Khalsa, et al. (2011) concluded that bright room light, compared to dim light, greatly disrupts sleep in the long run due to its impact on melatonin levels, which could also potentially have an effect on other health problems such as blood pressure and glucose homeostasis.

A study by Rahman, Hilaire, and Lockley (2017) found that exposure to blue light has the potential to disrupt circadian rhythm markers, such as the secretion of melatonin, and as a result, affect sleep quality. In addition, this study found that pre-bedtime exposure to blue-enriched LED light from the use of electronic devices such as phones, laptops, and tablets, also resulted in significant melatonin suppression and an increase in the time required to fall asleep. Rahman, Hilaire, and Lockley (2017) also found that the presence of dim light was more optimal for sleep in comparison to bright light, with the latter resulting in a suppression of melatonin production. Similarly, a study by Studer, Brucker, Haag, Doren, et al. (2018) compared blue-enriched light of high intensity to red-enriched light of high intensity amongst developing adolescents in the context of attention and sleep. They found that blue-enriched light greatly enhanced attention and alertness, compared to red-enriched light, on measures such as math test scores and reaction times, concluding that blue light increased alertness and reduced feelings of sleepiness. Furthermore, Studer, Brucker, Haag, Doren, et al. (2019) found that actigraphy measures of sleep indicated slight benefits for red-enriched light compared to blue-enriched light in the evening; the former reducing phases of movement activity after the onset of sleep.

With this literature in mind, the motivation for our current study was to find what *preferences* people had for light colour and intensities in regards to sleeping in nap pods. We wanted to explore if these personal preferences reflected previous literature. Since prior literature has shown that blue light negatively affects sleep equality, we wanted to see if students would then automatically and personally prefer warm-red tone light over blue light under napping conditions. Furthermore, we wanted to expand on the previous literature by exploring the effects of different lighting colours in general as well, and their implications on sleep since a significant amount of literature has focused only on blue light. We also felt motivated to do this particular study because we wanted to see if we could replicate the same findings as previous literature on sleep, but in regards to napping conditions.

Research Question and Hypothesis

Our research question for this study was, what is the effect of lighting colour and intensity on perceptions of comfort within nap pods? Keeping the results of previous literature in mind, we hypothesized that participants would rate red-warm colours higher on perceptions of calmness and sleepiness, and lower on perceptions of alertness and wakefulness, while cooler colours would show the opposite effect. Furthermore, in regards to light intensity, we hypothesized that participants would show a preference towards dimmer intensities of light, that is, they would rate the dim conditions higher on perceptions of calmness and sleepiness, independent of colour.

Methods

Participants

The participant sample in this study included 72 female and male university undergraduate students from the University of British Columbia, between the ages of 18-22. The demographics of the participants ranged in age, major, and gender. These ranges can be seen in Table 6.

Conditions

This study was conducted using a within subjects, repeated measures design, including 6 conditions (2x3) → Colour-Light intensity:

- Warm-dim, Warm-moderate, Warm-bright
- Cool-dim, Cool-moderate, Cool-bright

We defined warm light as having a reddish hue, and cool light as having a blue-ish hue.

Measures

The measure in this study was an electronic survey made by using the UBC Qualtrics Survey Software. The survey included a consent form, and a 5-point labelled Likert scale for each condition, in which participants viewed an image of a sleeping pod and rated their perceptions of calmness, sleepiness, alertness, and wakefulness. For an example, "1" meant *not calm at all*, while "5" meant *very calm*. The survey also included demographic questions in multiple choice format, such as age, gender, ethnic origin, and year-standing in university. Due to the nature of the study, participants were also asked if they were colour-blind. In addition to these questions, some general questions on sleeping habits and behaviours were collected as well, such as how many times participants napped per week, and how often they felt tired and sleepy at school. The 4 measures of the study were: calmness, alertness, sleepiness, and wakefulness; calmness and sleepiness being our measures of "comfort." The survey can be found in the appendix, labelled Table 5.

Procedure

Participants were electronically given a link to the survey throughout February and March, to be filled out at their own times. The survey began with a consent form, for which participants either chose *I consent to participate in this survey*, or *I do NOT consent to participate in this survey.* The next part of the survey consisted of questions pertaining to the levels of comfort, sleepiness, wakefulness, and alertness in regard to a photo of a sleeping pod with different lighting colour hues and intensities.

Results

Our experiment observed the effect of lighting colour and intensity on 4 separate measures: calmness, alertness, sleepiness, and wakefulness. We performed a two-way repeated measures (within-subjects) ANOVA on each of our measures since participants were exposed to every condition. Overall, we found that lighting colour and intensity had a significant effect on all 4 of our measures ($\alpha = 0.05$). The overall results of each measure can be found in the appendix, labelled Tables 1, 2, 3, and 4, respectively.

For calmness, we found that colour and intensity had a significant effect on participants' reported levels of calmness; F-value = 4.053, df = 5, p = 0.001 ($\alpha = 0.05$). The cool-moderate (M = 3.597, SD = 1.057) and warm-moderate (M = 3.597, SD = 0.914) conditions were rated the highest while the warm-bright (M = 3.042, SD = 1.131) condition was rated the lowest (see Table 1-A and Figure 1). A post-hoc Tukey test revealed that the cool- and warm-moderate conditions were the highest rated conditions and were significantly better than the warm-bright condition (see Table 1-B). This suggests both cool and warm colours at moderate levels can elicit feelings of calmness.

For alertness, we found that colour and intensity had a significant effect on participants' reported levels of alertness; F-value = 6.177, df = 5, $p < 0.001$ ($\alpha = 0.05$). The warm bright condition was rated the highest (M = 3.097, SD = 0.952) while the cool-moderate condition (M = 2.458, SD = 0.804) was rated the lowest (see Table 2-A and Figure 2). However, given that lower scores are preferred for this measure, the warm-bright condition can be understood as the least desirable condition. A post-hoc Tukey test revealed that the warm-bright condition was significantly different to all the other conditions apart from the cool-bright condition (see Table 2-B). The cool-moderate condition was rated the lowest and our post hoc Tukey test revealed that it was significantly different to the warm-bright condition, but not to the rest of the conditions. These results suggest that the warm-bright condition can elicit undesirable feelings of alertness, whereas cool-moderate can reduce this effect.

For sleepiness, we found that colour and intensity had a significant effect on participants' reported levels of sleepiness; F-value = 15.40, df = 5, $p < 0.001$ ($\alpha = 0.05$). the cool-dim condition (M = 3.542, SD = 1.087) was rated the highest and the warm-bright (M = 2.542, SD = 0.948) was rated the lowest (see Table 3-A and Figure 3). A post-hoc Tukey test revealed that the cool-dim condition was significantly different to the cool-bright (M = 2.778, SD = 0.982) and warm-bright conditions (see Table 3-B). These results suggest that the cool-dim condition elicited the strongest feelings of sleepiness, whereas both cool and warm colours at bright intensities prompt opposite feelings.

For wakefulness, we found that colour and intensity had a significant effect on participants' reported levels of wakefulness; F-value = 8.697, df = 5, $p < 0.001$ ($\alpha = 0.05$). The warm-bright condition (M = 3.083, SD = 0.975) was rated the highest and the cool-dim condition (M = 2.375, SD = 0.971) was rated the lowest (see Table 4-A and Figure 4). Like the alertness measure, lower scores are preferred for this measure. Thus, the cool-dim condition can be understood as the best condition. A post-hoc Tukey test revealed that cool-dim condition was significantly different to the cool- and warm-bright conditions. The cool- and warm-bright conditions were significantly different to every other measure (see Table 4-B). These results suggest that the cool- and warm-bright conditions elicited the strongest feelings of wakefulness, whereas the cool-dim condition elicited the weakest feelings of wakefulness.

Discussion

The purpose of our study was to find what the effects of lighting colour and intensity on perceptions of comfort would be for nap pods. Our results were not consistent with our hypothesis and previous research findings, that revealed how overall, participants actually preferred cool hues over warm hues of light instead. Participants rated the cool-moderate and cool-dim conditions to be highest on perceived calmness and sleepiness, respectively, although the warm-moderate condition scored the same as the cool-moderate condition. In addition, the cool conditions rated the lowest scores on both alertness and wakefulness. The warm conditions did not have a significant difference on feelings of calmness and sleepiness, and alertness and wakefulness, which suggests that perhaps the warm conditions did not have a significant effect on perceived feelings of sleepiness. Our results yielded an opposite effect to our hypothesis and to previous research, where warm tones were said to induce relaxation. However, results suggest that both light colour and intensity do have an effect on perceived feelings of sleepiness, specifically cool lighting hues and dim intensity. Overall, cooler colours and dim and moderate intensities were preferred by participants. Cooler colours scored higher on feelings of calmness and sleepiness and lower on feelings of alertness and wakefulness. Dim and moderate light intensity conditions were also overall preferred, with the brighter conditions scoring as the least preferred on all measures.

Limitations to our study included the lack of consideration for lighting intensity measurements. As discussed with the client, there are units of measurements for luminous intensity, referred to as “candela,” and “lumens,” which is a measure of visible light from a source. These units of measurements were not implemented into our study, however, could have clarified the specific intensity of lighting. Furthermore, screen brightness was not able to be controlled for, as participants who participated in the study may have had different levels of brightness on their respective screens while taking the survey. In addition, an experimental design would have been preferred but we were unable to execute this method for our research. An experimental design would have benefitted our study in terms of being able to explore what factors about certain lighting hues and intensities would induce sleepiness on a biological level, therefore possibly contributing to better sleep quality. Our study strictly focused on observing the correlation between lighting colour and intensity on perceived calmness and sleepiness, therefore not exploring any causal factors which may have contributed to eliciting sleepiness in an individual. An improvement that could be implemented for future studies is collecting a larger sample size, as our study only looked at results from 72 participants who mainly consisted of students from UBC. Additionally, specificity of lighting hue and intensity units would help yield clearer results in terms of being able to determine exact numbers and measurements, as we were only able to manipulate colour and intensity by editing a photograph. Creating an experimental design which would explore the effects of lighting on the human body on a biological level, would also be a significant improvement, as it would create suggestions for a comfortable environment for napping, thus allowing the napper to attain a good quality of sleep. The consideration of using energy efficient light bulbs could also be taken into account as a way to save energy.

Recommendations for your UBC client

There are several important implications and suggestions that can be drawn from this conducted research. We have demonstrated how both lighting intensity and colour are two elements that need to be taken into account when designing a napping environment, as it heavily influences one's perceived levels of calmness and sleepiness. With this in mind, we recommend to our client that they take into close consideration these two factors when designing the nap pods and more specifically, to use a cooler colour tone with a more dim light intensity to promote the feeling of a relaxed atmosphere for those who want to sleep in the pod. Furthermore, in light of environmental psychology, promoting sustainability is a primary goal as lights do affect the environment, including light pollution, energy usage, and the use of fossil fuels to generate this energy for lights. With these potential effects on the environment, we also suggest using energy efficient light bulbs in order to reduce the amount of waste and fossil fuels needed to be burned in order to generate electricity for light. Lastly, we also suggest including the option for changing the hue and dimming the light according to the individual's preferences, in order to cater to every napper's needs to the best of our ability.

References

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Appendix

Tables

Table 1. *Two-way repeated measures ANOVA for the Calmness measure indicating the F-value and p-value. The two independent variables were lighting colour (2 levels) and intensity (3 levels).*

Repeated Measures ANOVA - Calmness

Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p
Calmness	16.44 [a]	5 [a]	3.287 [a]	4.053 [a]	0.001 [a]
Residual	287.90	355	0.811		

Table 1-A. *Descriptive statistics for each condition (mean, standard deviation, number of participants)*

Calmness

Conditions	**Mean**	**SD**	**N**
CD	3.389	1.170	72
CM	3.597	1.057	72
CB	3.250	1.058	72
WD	3.319	1.059	72
WM	3.597	0.914	72
WB	3.042	1.131	72

Table 1-B. *Tukey's Post Hoc comparison for the Calmness measure.*

Post Hoc Comparisons - Calmness

		Mean Difference	SE	t	p_{tukey}	p_{bonf}
CD	CM	-0.208	0.145	-1.434	NaN	1.000
	CB	0.139	0.169	0.820	NaN	1.000
	WD	0.069	0.147	0.472	NaN	1.000
	WM	-0.208	0.141	-1.476	NaN	1.000
	WB	0.347	0.183	1.902	NaN	0.918
CM	CB	0.347	0.139	2.504	NaN	0.219
	WD	0.278	0.152	1.825	NaN	1.000
	WM	0.000	NaN	0.000	NaN	1.000
	WB	0.556	0.152	3.660	NaN	0.007
CB	WD	-0.069	0.161	-0.431	NaN	1.000
	WM	-0.347	0.147	-2.364	NaN	0.313
	WB	0.208	0.128	1.626	NaN	1.000
WD	WM	-0.278	0.127	-2.187	NaN	0.480
	WB	0.278	0.167	1.664	NaN	1.000
WM	WB	0.556	0.149	3.724	NaN	0.006

Table 2. *Two-way repeated measures ANOVA for the Alertness measure indicating the F-value and p-value.*

Repeated Measures ANOVA - Alertness

Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p
Alertness	19.53 [a]	5 [a]	3.906 [a]	6.177 [a]	< .001 [a]
Residual	224.47	355	0.632		

Table 2-A. *Descriptive statistics for each condition (mean, standard deviation, number of participants)*

Alertness

Conditions	**Mean**	**SD**	**N**
CD	2.528	0.949	72
CM	2.458	0.804	72
CB	2.792	0.871	72
WD	2.583	0.946	72
WM	2.625	0.846	72
WB	3.097	0.952	72

Table 2-B. *Tukey's Post Hoc comparison for the Calmness measure.*

Post Hoc Comparisons - Alertness

		Mean Difference	SE	t	p tukey	p bonf
CD	CM	0.069	0.107	0.648	NaN	1.000
	CB	-0.264	0.149	-1.767	NaN	1.000
	WD	-0.056	0.138	-0.402	NaN	1.000
	WM	-0.097	0.119	-0.817	NaN	1.000
	WB	-0.569	0.134	-4.253	NaN	< .001
CM	CB	-0.333	0.115	-2.890	NaN	0.077
	WD	-0.125	0.134	-0.932	NaN	1.000
	WM	-0.167	0.120	-1.385	NaN	1.000
	WB	-0.639	0.129	-4.966	NaN	< .001
CB	WD	0.208	0.156	1.338	NaN	1.000
	WM	0.167	0.144	1.157	NaN	1.000
	WB	-0.306	0.137	-2.238	NaN	0.425
WD	WM	-0.042	0.113	-0.370	NaN	1.000
	WB	-0.514	0.144	-3.569	NaN	0.010
WM	WB	-0.472	0.138	-3.412	NaN	0.016

Table 3 *Two-way repeated measures ANOVA for the Sleepiness measure indicating the F-value and p-value.*

Within Subjects Effects

	Sum of Squares	**df**	**Mean Square**	**F**	**p**
Sleepiness	53.88 [a]	5 [a]	10.776 [a]	15.40 [a]	< .001 [a]
Residual	248.45	355	0.700		

Table 3-A. *Descriptive statistics for each condition (mean, standard deviation, number of participants)*

Sleepiness

Conditions	**Mean**	**SD**	**N**
CD	3.542	1.087	72
CM	3.264	1.007	72
CB	2.778	0.982	72
WD	3.306	1.043	72
WM	3.375	1.013	72
WB	2.542	0.948	72

Table 3-B. *Tukey's Post Hoc comparison for the Sleepiness measure.*

Post Hoc Comparisons - Sleepiness

		Mean Difference	SE	t	p_{tukey}	p_{bonf}
CD	CM	0.278	0.147	1.890	NaN	0.943
	CB	0.764	0.149	5.138	NaN	< .001
	WD	0.236	0.142	1.663	NaN	1.000
	WM	0.167	0.151	1.106	NaN	1.000
	WB	1.000	0.153	6.527	NaN	< .001
CM	CB	0.486	0.108	4.488	NaN	< .001
	WD	-0.042	0.145	-0.288	NaN	1.000
	WM	-0.111	0.141	-0.790	NaN	1.000
	WB	0.722	0.127	5.687	NaN	< .001
CB	WD	-0.528	0.151	-3.504	NaN	0.012
	WM	-0.597	0.144	-4.161	NaN	0.001
	WB	0.236	0.142	1.663	NaN	1.000
WD	WM	-0.069	0.107	-0.648	NaN	1.000
	WB	0.764	0.145	5.280	NaN	< .001
WM	WB	0.833	0.131	6.351	NaN	< .001

Table 4. *Two-way repeated measures ANOVA for the Wakefulness measure indicating the F-value and p-value.*

Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p
Wakefulness	25.37 [a]	5 [a]	5.075 [a]	8.697 [a]	< .001 [a]
Residual	207.13	355	0.583		

Table 4-A. *Descriptive statistics for each condition (mean, standard deviation, number of participants)*

Wakefulness

Conditions	**Mean**	**SD**	**N**
CD	2.375	0.971	72
CM	2.500	0.872	72
CB	2.833	0.904	72
WD	2.486	0.856	72
WM	2.569	0.802	72
WB	3.083	0.975	72

Table 4-B. *Tukey's Post Hoc comparison for the Wakefulness measure.*

Post Hoc Comparisons - Wakefulness

		Mean Difference	SE	t	p_{tukey}	p_{bonf}
CD	CM	-0.125	0.120	-1.040	NaN	1.000
	CB	-0.458	0.147	-3.126	NaN	0.038
	WD	-0.111	0.115	-0.970	NaN	1.000
	WM	-0.194	0.113	-1.721	NaN	1.000
	WB	-0.708	0.150	-4.725	NaN	< .001
CM	CB	-0.333	0.105	-3.185	NaN	0.032
	WD	0.014	0.127	0.109	NaN	1.000
	WM	-0.069	0.114	-0.608	NaN	1.000
	WB	-0.583	0.131	-4.459	NaN	< .001
CB	WD	0.347	0.139	2.504	NaN	0.219
	WM	0.264	0.128	2.059	NaN	0.648
	WB	-0.250	0.150	-1.663	NaN	1.000
WD	WM	-0.083	0.096	-0.865	NaN	1.000
	WB	-0.597	0.142	-4.201	NaN	0.001
WM	WB	-0.514	0.117	-4.392	NaN	< .001

Figures

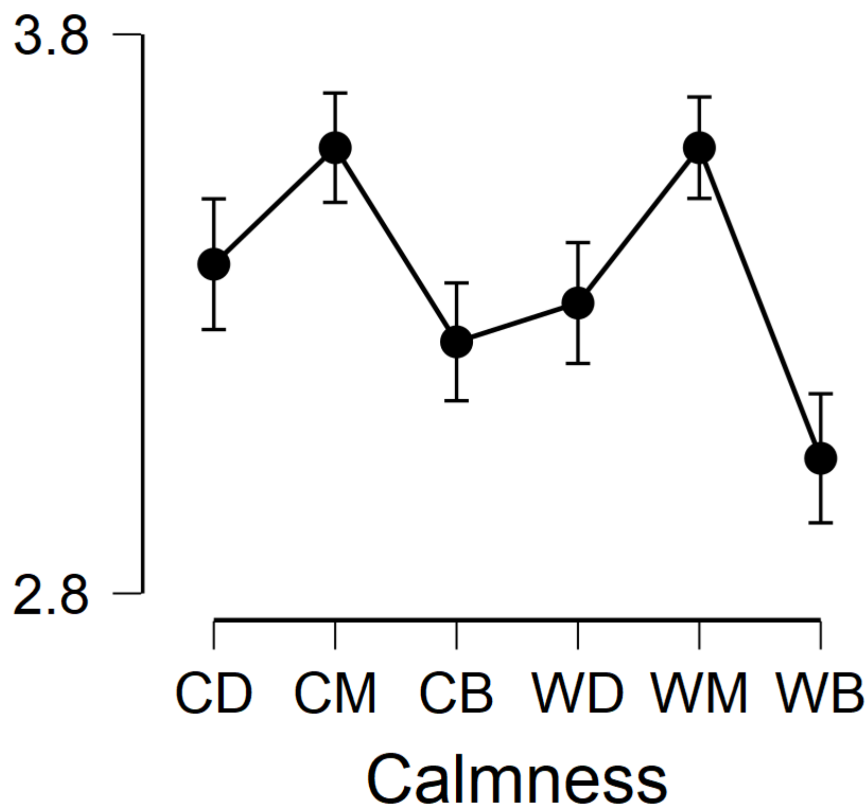


Figure 1. A plot graph showing the mean response of each condition with error bars. Higher scores are preferred.

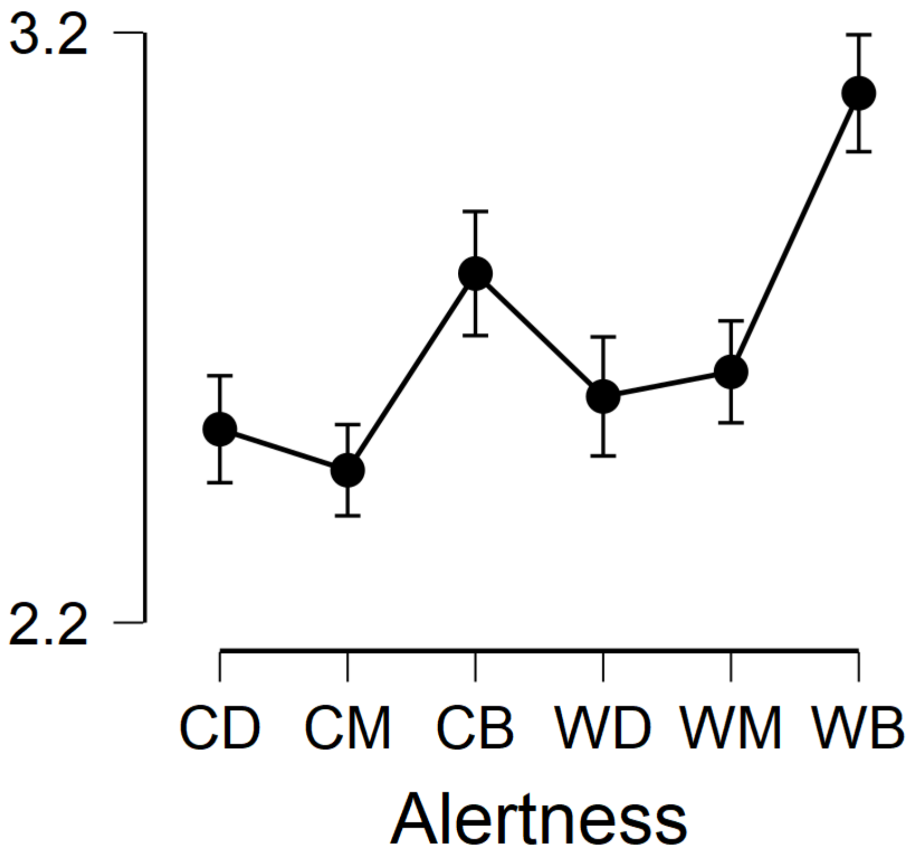


Figure 2. A plot graph showing the mean response of each condition with error bars. Lower scores are preferred.

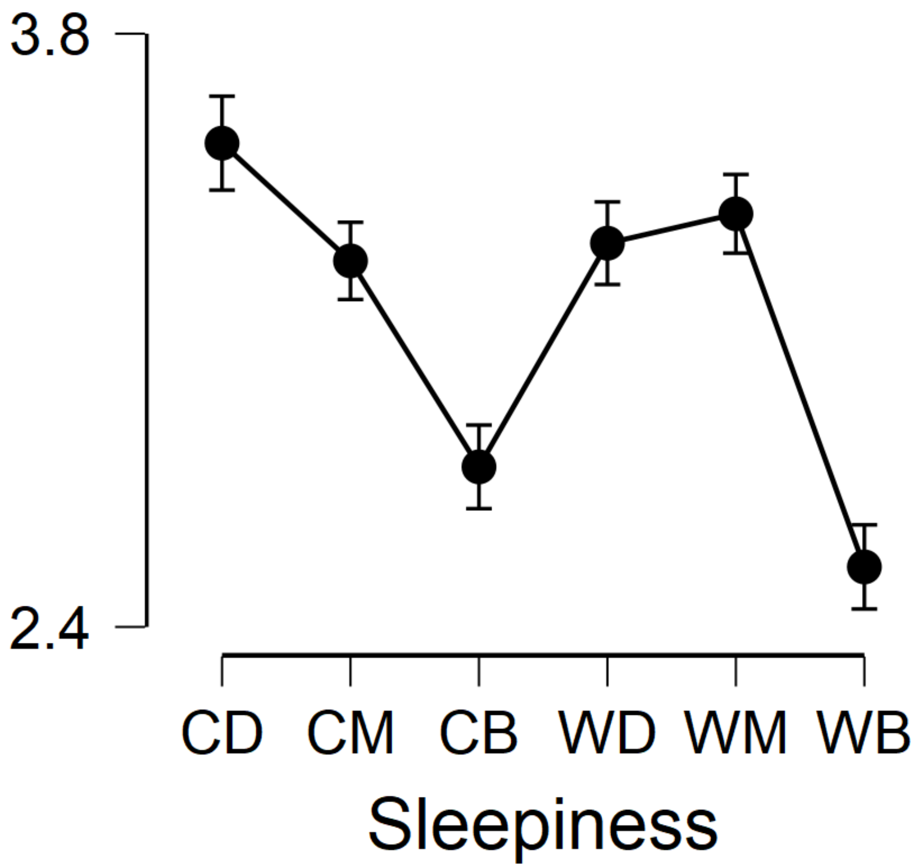


Figure 3. A plot graph showing the mean response of each condition with error bars. Higher scores are preferred.

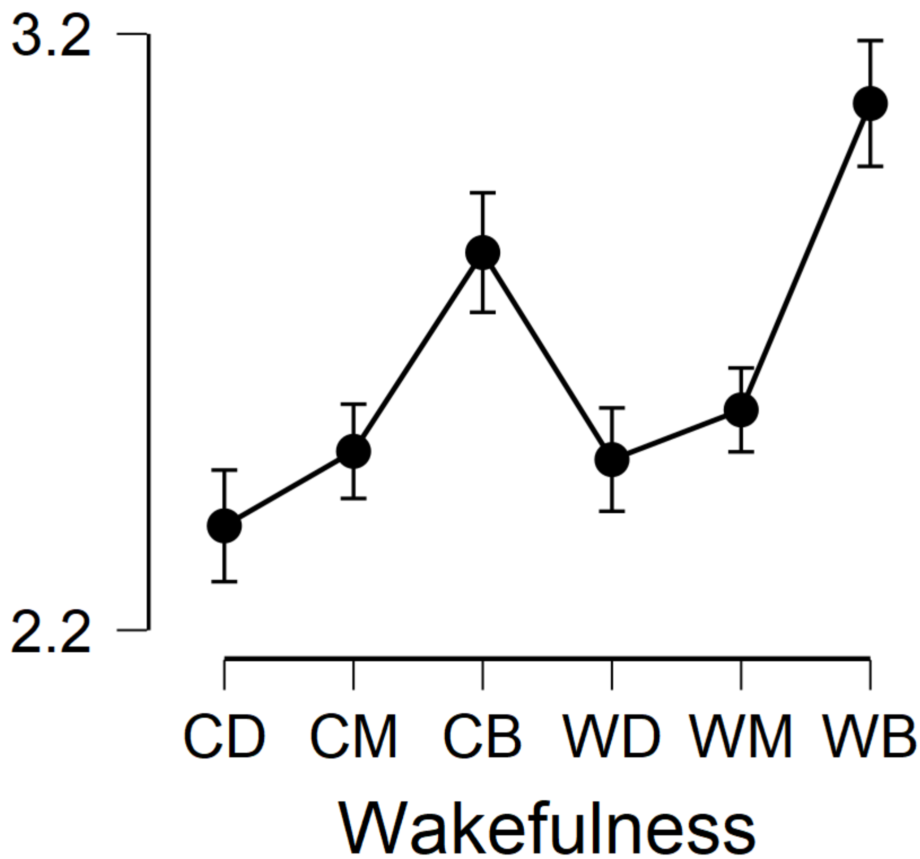


Figure 4. *A plot graph showing the mean response of each condition with error bars. Lower scores are preferred.*

Table 5. *Survey*

Rate your level of perceived calmness

	1	2	3	4	5	6	7	8	9	10	
Not calm at all	○	○	○	○	○	○	○	○	○	○	Very calm

Rate your level of perceived alertness

	1	2	3	4	5	6	7	8	9	10	
Not alert at all	○	○	○	○	○	○	○	○	○	○	Very alert

Rate your level of perceived sleepiness

	1	2	3	4	5	6	7	8	9	10	
Not sleepy at all	○	○	○	○	○	○	○	○	○	○	Very sleepy

Rate your level of perceived wakefulness

	1	2	3	4	5	6	7	8	9	10	
Not awake at all	○	○	○	○	○	○	○	○	○	○	Very awake

Rate your level of perceived calmness

	1	2	3	4	5	6	7	8	9	10	
Not calm at all	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very calm

Rate your level of perceived alertness

	1	2	3	4	5	6	7	8	9	10	
Not alert at all	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very alert

Rate your level of perceived sleepiness

	1	2	3	4	5	6	7	8	9	10	
Not sleepy at all	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very sleepy

Rate your level of perceived wakefulness

	1	2	3	4	5	6	7	8	9	10	
Not awake at all	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very awake

Rate your level of perceived calmness

	1	2	3	4	5	6	7	8	9	10	
Not calm at all	○	○	○	○	○	○	○	○	○	○	Very calm

Rate your level of perceived alertness

	1	2	3	4	5	6	7	8	9	10	
Not alert at all	○	○	○	○	○	○	○	○	○	○	Very alert

Rate your level of perceived sleepiness

	1	2	3	4	5	6	7	8	9	10	
Not sleepy at all	○	○	○	○	○	○	○	○	○	○	Very sleepy

Rate your level of perceived wakefulness

	1	2	3	4	5	6	7	8	9	10	
Not awake at all	○	○	○	○	○	○	○	○	○	○	Very awake

Rate your level of perceived calmness

	1	2	3	4	5	6	7	8	9	10	
Not calm at all	○	○	○	○	○	○	○	○	○	○	Very calm

Rate your level of perceived alertness

	1	2	3	4	5	6	7	8	9	10	
Not alert at all	○	○	○	○	○	○	○	○	○	○	Very alert

Rate your level of perceived sleepiness

	1	2	3	4	5	6	7	8	9	10	
Not sleepy at all	○	○	○	○	○	○	○	○	○	○	Very sleepy

Rate your level of perceived wakefulness

	1	2	3	4	5	6	7	8	9	10	
Not awake at all	○	○	○	○	○	○	○	○	○	○	Very awake

Rate your level of perceived calmness

	1	2	3	4	5	6	7	8	9	10	
Not calm at all	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very calm

Rate your level of perceived alertness

	1	2	3	4	5	6	7	8	9	10	
Not alert at all	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very alert

Rate your level of perceived sleepiness

	1	2	3	4	5	6	7	8	9	10	
Not sleepy at all	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very sleepy

Rate your level of perceived wakefulness

	1	2	3	4	5	6	7	8	9	10	
Not awake at all	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very awake

Rate your level of perceived calmness

	1	2	3	4	5	6	7	8	9	10	
Not calm at all	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very calm

Rate your level of perceived alertness

	1	2	3	4	5	6	7	8	9	10	
Not alert at all	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very alert

Rate your level of perceived sleepiness

	1	2	3	4	5	6	7	8	9	10	
Not sleepy at all	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very sleepy

Rate your level of perceived wakefulness

	1	2	3	4	5	6	7	8	9	10	
Not awake at all	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very awake

Rate your level of perceived calmness

	1	2	3	4	5	6	7	8	9	10	
Not calm at all	○	○	○	○	○	○	○	○	○	○	Very calm

Rate your level of perceived alertness

	1	2	3	4	5	6	7	8	9	10	
Not alert at all	○	○	○	○	○	○	○	○	○	○	Very alert

Rate your level of perceived sleepiness

	1	2	3	4	5	6	7	8	9	10	
Not sleepy at all	○	○	○	○	○	○	○	○	○	○	Very sleepy

Rate your level of perceived wakefulness

	1	2	3	4	5	6	7	8	9	10	
Not awake at all	○	○	○	○	○	○	○	○	○	○	Very awake

Rate your level of perceived calmness

	1	2	3	4	5	6	7	8	9	10	
Not calm at all	○	○	○	○	○	○	○	○	○	○	Very calm

Rate your level of perceived alertness

	1	2	3	4	5	6	7	8	9	10	
Not alert at all	○	○	○	○	○	○	○	○	○	○	Very alert

Rate your level of perceived sleepiness

	1	2	3	4	5	6	7	8	9	10	
Not sleepy at all	○	○	○	○	○	○	○	○	○	○	Very sleepy

Rate your level of perceived wakefulness

	1	2	3	4	5	6	7	8	9	10	
Not awake at all	○	○	○	○	○	○	○	○	○	○	Very awake

Rate your level of perceived calmness

	1	2	3	4	5	6	7	8	9	10	
Not calm at all	○	○	○	○	○	○	○	○	○	○	Very calm

Rate your level of perceived alertness

	1	2	3	4	5	6	7	8	9	10	
Not alert at all	○	○	○	○	○	○	○	○	○	○	Very alert

Rate your level of perceived sleepiness

	1	2	3	4	5	6	7	8	9	10	
Not sleepy at all	○	○	○	○	○	○	○	○	○	○	Very sleepy

Rate your level of perceived wakefulness

	1	2	3	4	5	6	7	8	9	10	
Not awake at all	○	○	○	○	○	○	○	○	○	○	Very awake

Rate your level of perceived calmness

	1	2	3	4	5	6	7	8	9	10	
Not calm at all	○	○	○	○	○	○	○	○	○	○	Very calm

Rate your level of perceived alertness

	1	2	3	4	5	6	7	8	9	10	
Not alert at all	○	○	○	○	○	○	○	○	○	○	Very alert

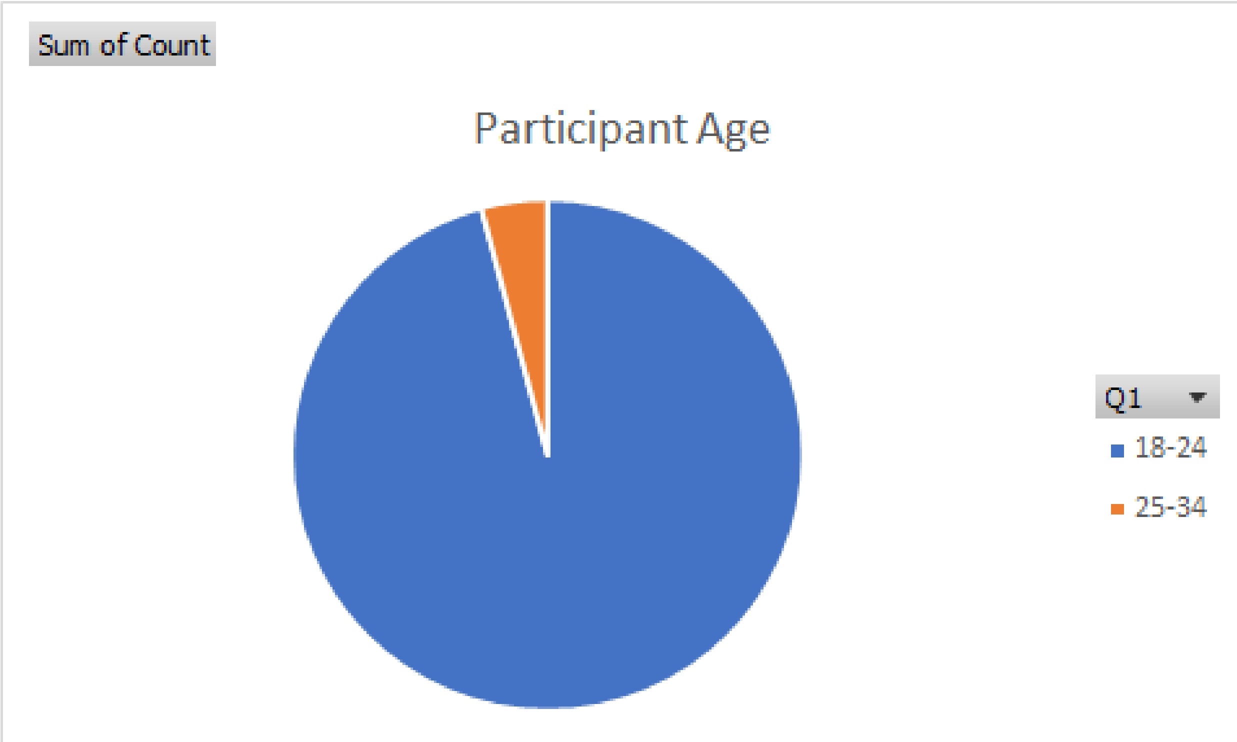
Rate your level of perceived sleepiness

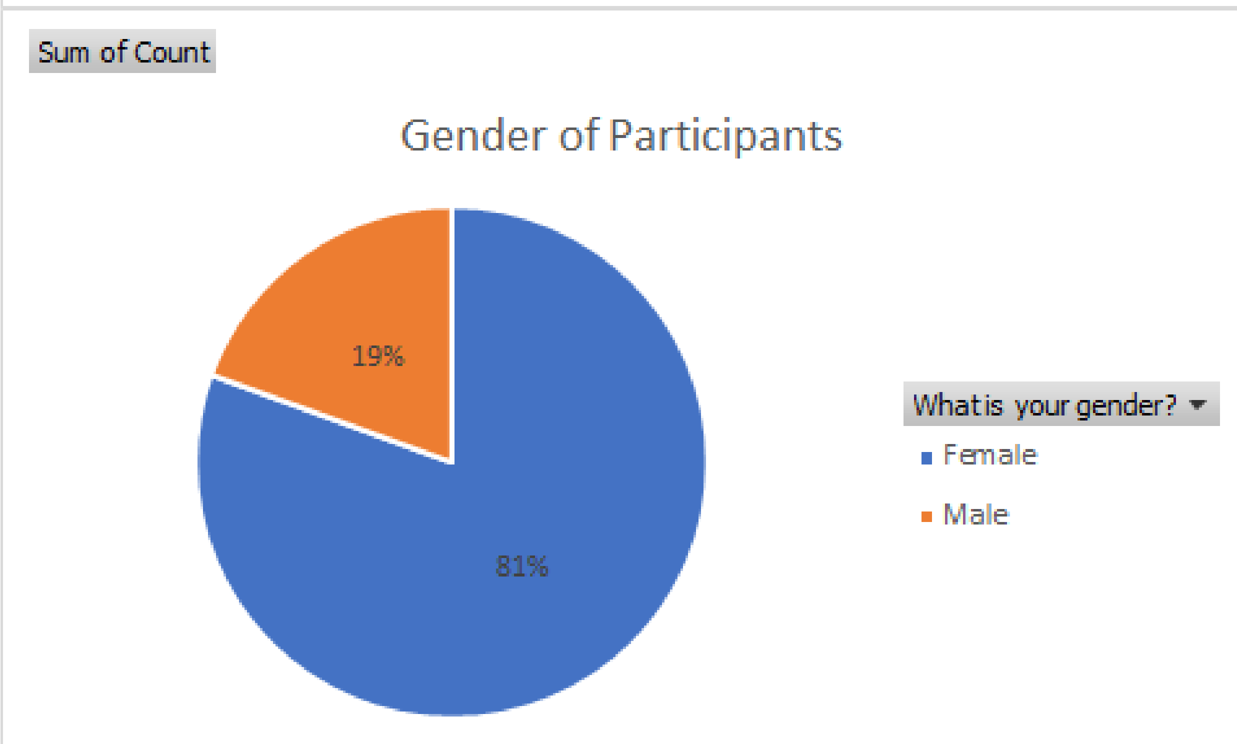
	1	2	3	4	5	6	7	8	9	10	
Not sleepy at all	○	○	○	○	○	○	○	○	○	○	Very sleepy

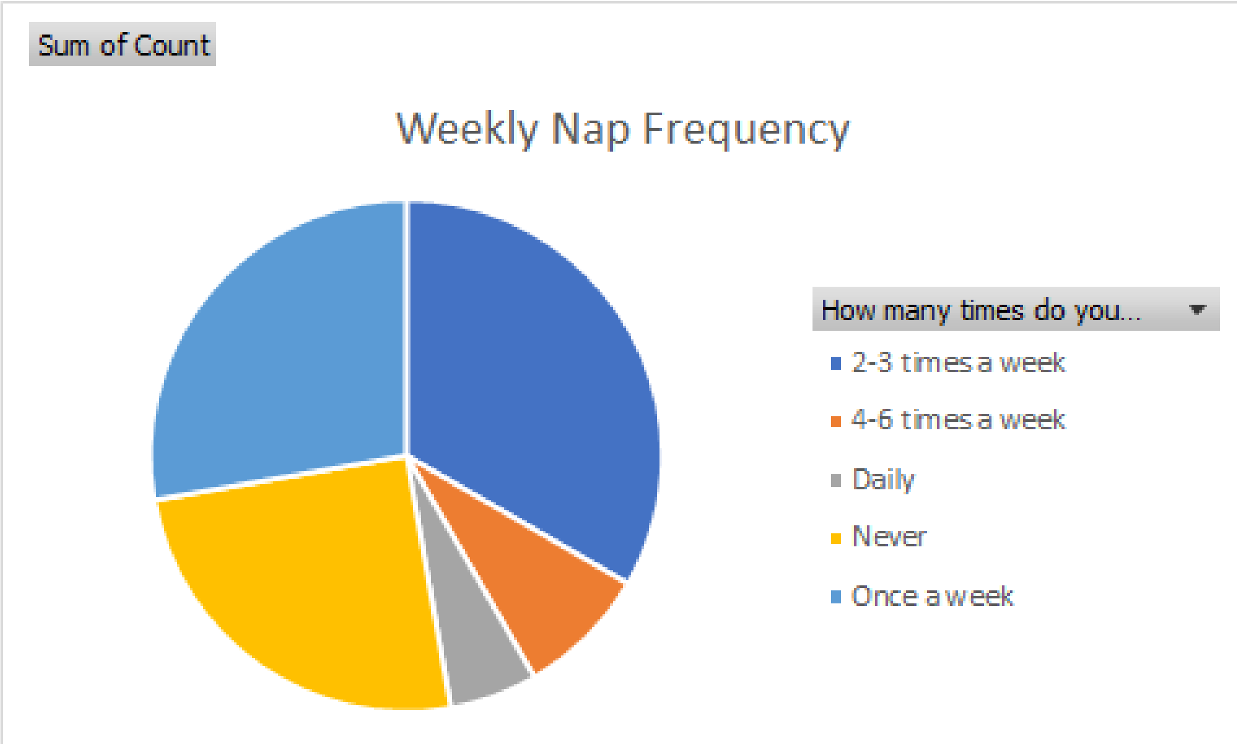
Rate your level of perceived wakefulness

	1	2	3	4	5	6	7	8	9	10	
Not awake at all	○	○	○	○	○	○	○	○	○	○	Very awake

Table 6. *Demographic Ranges*.






Sum of Count
Weekly Nap Frequency
How many times do you...
2-3 times a week
4-6 times a week
Daily
Never
Once a week