The Relationship Between Noise and Privacy in UBC Students' Study Spaces and Reported Stress Levels

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The Relationship Between Noise and Privacy in UBC Students' Study Spaces and Reported Stress Levels

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Executive Summary

We examined whether reported noise and privacy levels in University of British Columbia's (UBC) students' study spaces on campus are related to their levels of perceived stress through a quasi-experimental study. Data from N=101 UBC students were gathered through a survey at 3 different locations on campus: Irving K. Barber Learning Commons (IKBLC) Commons, IKBLC Silent Study, and Koerner Cubicles. As predicted, students studying in study spaces with higher noise and lower privacy levels (IKBLC Commons) reported higher levels of stress compared to students studying in spaces with lower noise and higher privacy levels (Koerner Cubicles). We found a moderate positive relationship between reported noise and stress levels and a moderate negative relationship between reported privacy and stress levels. Implications and limitations of the study are discussed, along with recommendations for UBC.

Keywords: stress, noise, privacy, study space, campus

The Relationship Between Noise and Privacy in UBC Students' Study Spaces and Reported Stress Levels

As part of the University of British Columbia (UBC) Social Ecological Economic Development Studies (SEEDS) Wellbeing Initiative, we were asked to look into what it is about students' academic environment that causes them stress. UBC's Wellbeing Initiative (2015) conceptualizes wellbeing as a balance between different aspects of health such as academic and intellectual health, emotional health, personal health, physical health, play, social health, spiritual health, and work and financial health. Lazarus and Folkman (1984) defined stress as "a relationship between a person and their environment which is appraised as taxing and endangers his or her wellbeing" (as cited in Bell et al., 2012, p. 26). Negative impacts of stress on wellbeing have been researched and well-documented in the past. Previous research has found that stress has a major impact on mood, behaviour, sense of wellbeing and health (Schneiderman et al., 2005). In the learning environment, higher stress-induced cortisol levels are associated with impaired memory function (Conrad, 2012). In the work place, stress is correlated to poor work-life balance and conflicts between personal life and academic work (Bell et al., 2012). Studies have also found a causal relation between stress and major depression over time (Hammen, 2005). With these research findings in mind, we set out to identify what variables in students' study environment are related to stress.

A study by Choi and McPherson (2007) found that irrelevant classroom noise impedes attention in a learning context. Guski (2001) found that an environmental stressor like noise leads to physiological and psychological discomfort. Other studies have shown that noise levels are one of the strongest correlates to psychological wellbeing (Klitzman & Stellman, 1989). Also, previous studies have found that perceived insufficient privacy is directly related to psychosomatic stress (Webb, 1978). Based on these previous findings, our research examined whether noise and privacy levels in UBC students' study spaces are related to their reported stress levels. We hypothesized that students studying in locations with higher noise and lower privacy levels would report higher levels of stress than students studying in locations with lower noise and higher privacy.

Methods

Participants

Our participant population was UBC students (N=101; 95 undergraduate, 6 graduate) who were studying on the UBC Point Grey campus.

Conditions

Our study was a between-subjects, independent-measures design. We conducted our surveys at 3 different locations with varying noise and privacy levels. Our conditions were:

1) "IKBLC Commons": We chose the third floor open study space at IKBLC (Irving K. Barber Learning Commons) as satisfying the high noise and low privacy condition (see Appendix A, Photograph A1).
2) "IKBLC Silent Study": We chose the third floor Musqueam and Nass silent study rooms at IKBLC as satisfying the low noise and low privacy condition (see Photograph A2).

3) "Koerner Cubicles": We chose the second floor silent cubicles at Koerner Library as satisfying the low noise and high privacy condition (see Photograph A3).

Unfortunately, we were unable to find a location on campus that satisfied the high noise and high privacy condition.

Measures

We designed a survey (see Appendix B) and developed our own set of questions that asked students to report their perceived levels of noise, privacy, and stress on a Likert scale of intensity (1 being lowest, 5 being highest). We asked students to report their stress levels and asked an open-ended question about what factors contribute to their stress on the first page to avoid being leading or suggestive. The second page included questions that asked students to report their perceived levels of noise and privacy in their study space to see if the locations satisfied the conditions of low versus high noise and privacy.

We also took objective measurements of noise and privacy at each location to see how they compared with the levels reported by students. To measure the noise, we used an app called SoundMeter to take decibel measurements from three different spots at each location and computed the mean average decibel level for that location. For privacy, we sat down at three different spots at opposing sides of the room at each location and counted the number of faces we could see. Then, we calculated the mean average number of faces for that location. We chose to use this method because it was a quick and efficient way to visually quantify the level of privacy from others' presence.

Procedure

We asked students to fill out our survey on Tuesday, March 10th 2015 between 11:30am and 1:00pm. All participants provided verbal or written informed consent (see Appendix C) prior to completing the surveys and were given mini granola bars for their participation. We conducted 33 surveys from IKBLC Commons, 31 from IKBLC Silent Study, and 37 from Koerner Cubicles.

Results

We used inferential statistics to analyze our research findings. We used a one-way ANOVA for each variable (noise, privacy, and stress) to see if there were statistically significant differences between the mean levels reported at each location.

Firstly, we analyzed reported noise and privacy to see if the locations that we chose satisfied our conditions. A one-way ANOVA for reported noise (see Appendix D, Table D2) found a statistically significant difference between locations ($F(2,98) = 58.700$, $p = .000$). A Tukey post-hoc test for reported noise (Table D3) revealed that reported noise was significantly higher in IKBLC Commons ($3.48 \pm .12$) than Koerner Cubicles ($1.58 \pm .85$, $p = .000$) or IKBLC Silent Study ($1.58 \pm .19$, $p = .000$). No statistical difference was found for reported noise between IKBLC Silent Study and Koerner Cubicles ($p = .207$). A one-way ANOVA for reported privacy (see Appendix E, Table E2) revealed a statistically significant difference between locations ($F(2,98) = 16.615$, $p = .000$). A Tukey post-hoc test for reported privacy (Table E3) showed that reported privacy was significantly higher in Koerner Cubicles ($3.26 \pm .95$) than IKBLC Commons ($1.94 \pm .93$, $p = .000$) or IKBLC Silent Study (2.42 ± 1.03, $p = .002$). There was no statistical difference for reported privacy between IKBLC Commons and IKBLC Silent

Study (p = .123). In addition, there was a difference in objective measures of noise and privacy between IKBLC Commons and Koerner Cubicles (Appendix F). These combined findings confirmed that IKBLC Commons and Koerner Cubicles significantly differed on levels of reported noise and privacy, and therefore satisfied our conditions.

Secondly, a one-way ANOVA for reported stress (see Appendix G, Table G2) found a statistically significant difference between locations ($F(2,98) = 4.501$, p = .013). A Tukey post-hoc test for reported stress (Table G3) showed that reported stress was significantly higher in IKBLC Commons (3.45 ± 1.06, p = .011) than Koerner Cubicles (2.68 ± 1.06). There was no statistically significant difference for reported stress between IKBLC Commons and IKBLC Silent Study (p = .537), nor between IKBLC Silent Study and Koerner Cubicles (p = .170).

Finally, we calculated the two-tailed Pearson r and found a moderate positive correlation (r (99) = .314, p = .001) between reported levels of noise and stress (see Appendix H, Table H1) and a moderate negative correlation (r (99) = -.313, p = .001) between reported levels of privacy and stress (Table H2). The mean reported levels of noise, privacy, and stress at each study location is shown in Appendix I. This bar graph clearly shows two patterns: as reported noise levels go down, reported stress levels go down, and as reported privacy levels go up, reported stress levels go down.

Discussion

Our study results indicate that students' reported levels of stress is associated with reported privacy and noise levels and thus supports our hypothesis that students studying in study spaces with reportedly higher noise levels and lower privacy levels would report higher stress levels compared to students studying in study spaces with reportedly lower noise and higher privacy levels.

Limitations and Challenges

Some limitations in our study was that we did not consider other confounding participant variables that could have influenced our results such as gender, age, culture, familiarity with the UBC campus, individual preferences of study spaces, and whether students had upcoming deadlines. Also, we only looked at two variables and did not take into account other variables besides noise and privacy that could have been related to stress. We didn't differentiate between different types of noise and privacy, which could have produced different results. In addition, we cannot infer any causal directionality because our study was not an experimental design. This means that participants were not randomly assigned to conditions and we were not able to manipulate the independent variables.

Our measures of noise, privacy, and stress relied mainly on self-reports by students and hence were not objective. Our baseline objective measures of noise and privacy were not reliable as stand-alone variables, as we only took 3 measurements at each location. This also meant that our comparison of objective measures and reported measures of noise and privacy did not yield statistically significant correlations. Furthermore, our method of objective measurement for noise levels was not fully reliable since we used the app SoundMeter, which may not be as reliable as a higher functioning decibel measuring device. Our method of counting the number of visible faces for an objective measurement of privacy levels is also not an established, valid measure in experimental studies. Finally, our sample size of 101

participants was big enough to run a statistical analysis and test for significance, but was not representative of the entire UBC population.

Implications and Directions for Future Studies

Despite these limitations, our study can provide the foundation for future research and can have implications for designing study spaces on and off campus. As our study has established a moderate correlational relationship between reported noise, privacy, and stress, this provides the basis for future research into a potential causal relationship. Therefore, an experimental design which utilizes random selection, random assignment, bigger sample size, independent variable manipulation, objective measurements of the three variables, and third variable controls may look at whether noise and privacy has causal effects on stress. Future studies may also research other variables besides noise and privacy that may be related to or influence stress, such as lighting, presence of greenery, or color scheme.

Some studies have reported that different types of noise, such as speech in informal learning spaces were not detrimental to students' degree of wellbeing (Scannell et al., 2014). Another study found that the unpredictability of noise, not the actual decibel level, had negative effects on workers (Klitzman & Stellman, 1989). Based on these findings, a future study should research what it is about noise or privacy that is related to stress and whether different types of noise and privacy in study spaces could relate to different levels of stress. Therefore, examining alternative study locations not covered by our study, such as coffee shops and the outdoors, may also be of interest.

Other directions for future research include looking into ways for reducing stress-related variables like high noise and low privacy. For example, an experiment may test whether the use of dividers on tables in existing study spaces (thereby increasing privacy) leads to a decrease in stress. Therefore, our current study and future studies can have implications for designing workspaces on and off campus.

Recommendations for UBC

While keeping the results of this study in mind, UBC may want to design future study spaces in a way that minimizes stress-related factors like high levels of noise and low levels of privacy. In addition, considering altering the physical layout of current study spaces to improve privacy and noise levels may prove beneficial. This could be done through either implementing dividers on existing surfaces in open study areas, larger room dividers around tables to minimize the travelling of sound, or the addition of more private cubicles. Another option for UBC to consider is to rearrange current study spaces to increase privacy and reduce noise by avoiding putting open study spaces in high traffic areas. For example, the hallways in the IKBLC Commons are lined with open tables and are situated where there is heavy foot traffic and are close in proximity to bathrooms that serve the entire floor, meaning less privacy due to consistent movement. In this case, the addition of dividers or cubicles to line the hallway may potentially increase privacy by obstructing the view of movement from those studying.

UBC may also want to consider the results of this study when deciding how to allocate floor space to study environments and when budgeting for renovations to minimize stress-related variables and to prioritize student wellbeing rather than the aesthetics of the building. Our study has only looked at noise and privacy but UBC students may have very different ideas about what constitutes an ideal study space. Therefore, establishing an open dialogue between

students and faculty to identify some of those other variables may be beneficial. This may be done through online surveys, polls, comment boxes on campus, or through other means.

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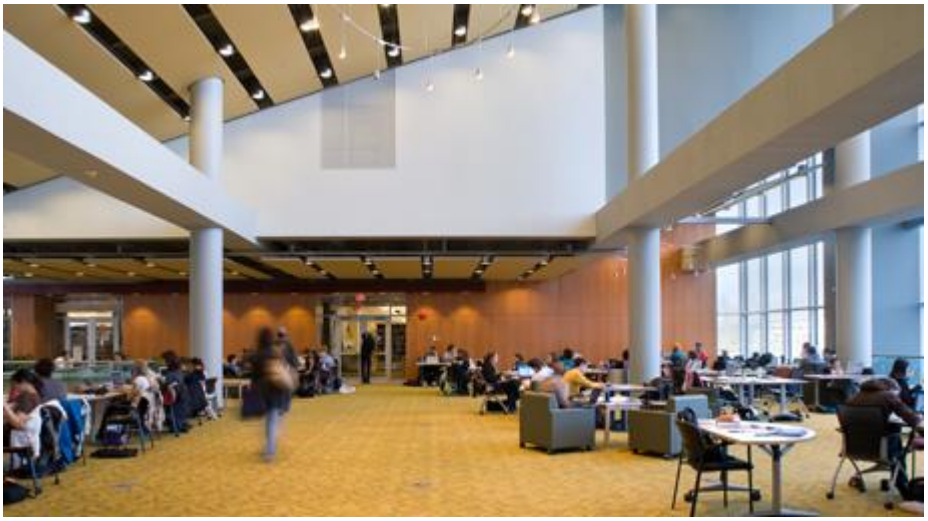
Appendix A

Photographs

Photograph A1: IKBLC Commons



Photograph A2: IKBLC Silent Study

Photograph A3: Koerner Cubicles

Appendix B

Survey

a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Student Survey on Wellbeing

1. Are you a UBC Student? Please circle yes or no.

   Yes No

2. Which level of study are you in? Please circle the correct answer.

   Undergraduate Graduate

3. List 3 of the most stressful factors about your current study environment.

   _____

   _____

   _____

4. In choosing a study space, what quality is most important to you?

   _____

5. How stressed do you feel at this moment? Circle the correct level on the following scale.

1	2	3	4	5
Not stressed				Very stressed

6. In your current study environment, rate the level of **noise**. Circle the correct level on the following scale.

1	2	3	4	5
Not noisy				Very noisy

7. In your current study environment, rate the level of **privacy**. Circle the correct level on the following scale.

1	2	3	4	5
Not private				Completely private

8. How much do you think your current study environment contributes to your stress level? Circle the correct degree on the following scale.

1	2	3	4	5
Does not contribute				Strongly contributes

You are finished! Thank you for taking part in this survey ☺

Appendix C

Consent Form

Consent Form

Welcome to our study. We are running a survey on well-being as our group project for the PSYC 321-Environmental Psychology course. The survey will take about 3 minutes to complete. You will answer a series of questions on your study environment and stress in the survey.

Your participation in this survey is entirely voluntary and anonymous. You can refuse to participate or withdraw from the survey at any time. Your identity will be kept strictly confidential. All documents will be identified only by code number and stored securely. You will not be identified by name in any reports of this study. Data in this survey will only be accessed by the students, the course instructor, and the teaching assistant. Results of this study will be used to write a research report. There are no risks associated with participating in this survey.

If you have any questions about the study, please contact us below.

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Ellyce Uy, ellyceestelle@gmail.com, 604-722-5742

Kate Kim, katekim.89@gmail.com, 778-861-8282

You can also contact the course instructor, Dr. Jiaying Zhao, assistant professor in the Department of Psychology and the Institute for Resources, Environment and Sustainability at UBC. Dr. Zhao can be reached at at 604-827-2203, or environmentalpsychology321@gmail.com.

If you consent to participate in this study, please proceed to the next page.

Appendix D

Tables on Reported Noise Levels (Statistical Analysis from SPSS)

Table D1

Descriptives Analysis on Reported Noise by Location

Reported Noise Level

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
IKBLC Commons	33	3.4848	.71244	.12402	3.2322	3.7375	2.00	5.00
IKBLC Silent Study	31	1.9032	.74632	.13404	1.6295	2.1770	1.00	3.00
Koerner Cubicles	37	1.5811	.84585	.13906	1.2991	1.8631	1.00	4.50
Total	101	2.3020	1.13596	.11303	2.0777	2.5262	1.00	5.00

Table D2

One-Way ANOVA on Reported Noise between Locations

Reported Noise Level

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	70.331	2	35.165	58.700	.000
Within Groups	58.709	98	.599		
Total	129.040	100			

Table D3

Tukey Post-Hoc Test on Reported Noise by Location

Dependent Variable: Reported Noise Level

Tukey HSD

(I) Location	(J) Location	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
IKBLC Commons	IKBLC Silent Study	1.58162*	.19359	.000	1.1209	2.0423
	Koerner Cubicles	1.90377*	.18532	.000	1.4627	2.3448
IKBLC Silent Study	IKBLC Commons	-1.58162*	.19359	.000	-2.0423	-1.1209
	Koerner Cubicles	.32214	.18846	.207	-.1264	.7706
Koerner Cubicles	IKBLC Commons	-1.90377*	.18532	.000	-2.3448	-1.4627
	IKBLC Silent Study	-.32214	.18846	.207	-.7706	.1264

*. The mean difference is significant at the 0.05 level.

Appendix E

Tables on Reported Privacy Levels (Statistical Analysis from SPSS)

Table E1

Descriptives Analysis on Reported Privacy by Location

Reported Privacy Level

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
IKBLC Commons	33	1.9394	.93339	.16248	1.6084	2.2704	1.00	5.00
IKBLC Silent Study	31	2.4194	1.02548	.18418	2.0432	2.7955	1.00	4.00
Koerner Cubicles	37	3.2568	.95468	.15695	2.9385	3.5751	1.00	5.00
Total	101	2.5693	1.11137	.11059	2.3499	2.7887	1.00	5.00

Table E2

One-Way ANOVA on Reported Privacy between Locations

Reported Privacy Level

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	31.277	2	15.638	16.615	.000
Within Groups	92.238	98	.941		
Total	123.515	100			

Table E3

Tukey Post-Hoc Test on Reported Privacy by Location

Dependent Variable: Reported Privacy Level

Tukey HSD

(I) Location	(J) Location	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
IKBLC Commons	IKBLC Silent Study	-.47996	.24266	.123	-1.0574	.0975
	Koerner Cubicles	-1.31736*	.23229	.000	-1.8702	-.7645
IKBLC Silent Study	IKBLC Commons	.47996	.24266	.123	-.0975	1.0574
	Koerner Cubicles	-.83740*	.23622	.002	-1.3996	-.2752
Koerner Cubicles	IKBLC Commons	1.31736*	.23229	.000	.7645	1.8702
	IKBLC Silent Study	.83740*	.23622	.002	.2752	1.3996

*. The mean difference is significant at the 0.05 level.

Appendix F

Tables and Figures on Objective Measures of Noise and Privacy (Statistical Analysis from SPSS)

Table F1

Correlations between Objective Measure & Reported Level of Noise

		Objective Measure of Noise	Reported Level of Noise
Objective Measure of Noise	Pearson Correlation	1	.98
	Sig. (2-tailed)		.141
	N	3	3
Reported Level of Noise	Pearson Correlation	.98	1
	Sig. (2-tailed)	.141	
	N	3	3

Table F2

Correlations between Objective Measure & Reported Level of Privacy

		Objective Measure of Privacy	Reported Level of Privacy
Objective Measure of Privacy	Pearson Correlation	1	.99
	Sig. (2-tailed)		.099
	N	3	3
Reported Level of Privacy	Pearson Correlation	.99	1
	Sig. (2-tailed)	.099	
	N	3	3

Figure F3.

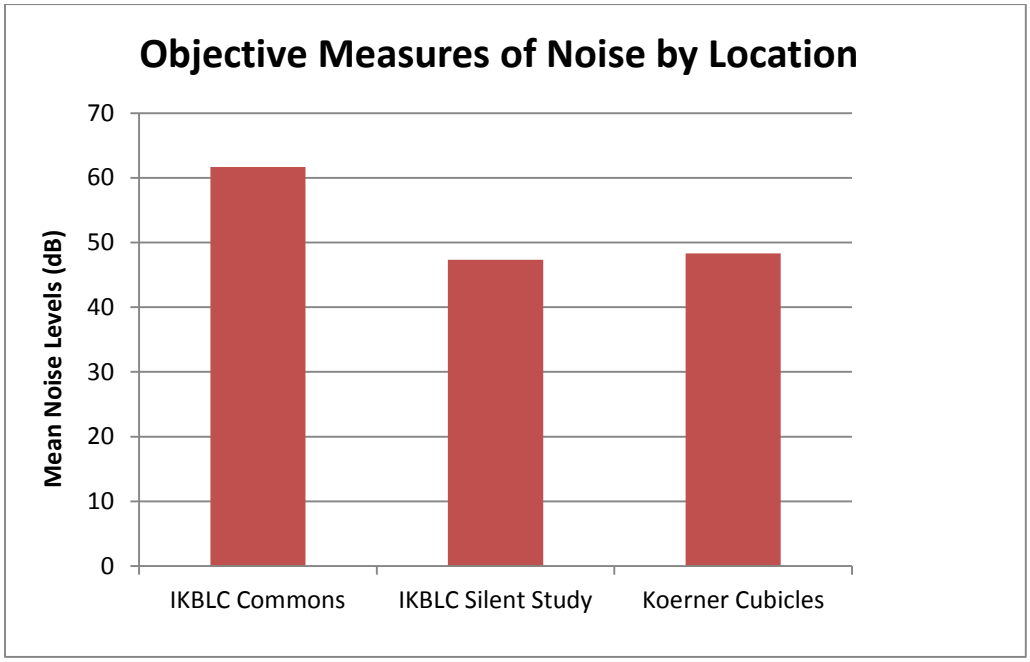
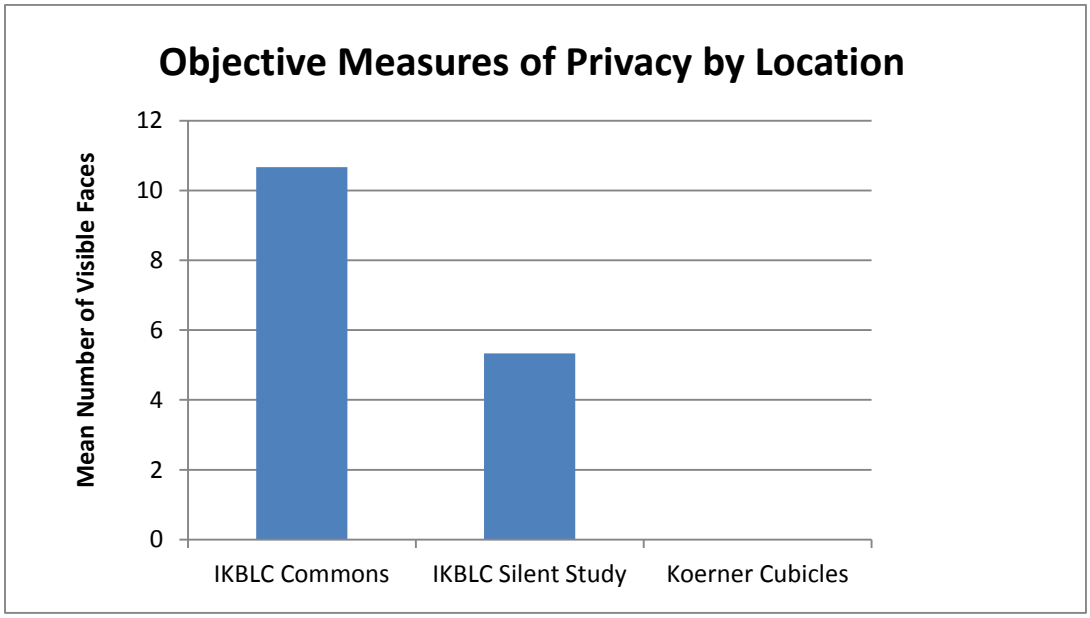


Figure F4.



Appendix G

Tables on Reported Stress Levels (Statistical Analysis from SPSS)

Table G1

Descriptives Analysis on Reported Stress by Location

Reported Stress Level

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
IKBLC Commons	33	3.4545	1.06334	.18510	3.0775	3.8316	1.00	5.00
IKBLC Silent Study	31	3.1613	1.18594	.21300	2.7263	3.5963	1.00	5.00
Koerner Cubicles	37	2.6757	1.05552	.17353	2.3237	3.0276	1.00	5.00
Total	101	3.0792	1.13739	.11317	2.8547	3.3037	1.00	5.00

Table G2

One-Way ANOVA on Reported Stress between Locations

Reported Stress Level

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10.883	2	5.441	4.501	.013
Within Groups	118.483	98	1.209		
Total	129.366	100			

Table G3

Tukey Post-Hoc Test on Reported Stress by Location

Dependent Variable: Reported Stress Level

Tukey HSD

(I) Location	(J) Location	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
IKBLC Commons	IKBLC Silent Study	.29326	.27502	.537	-.3613	.9478
	Koerner Cubicles	.77887*	.26327	.011	.1523	1.4054
IKBLC Silent Study	IKBLC Commons	-.29326	.27502	.537	-.9478	.3613
	Koerner Cubicles	.48561	.26772	.170	-.1515	1.1228
Koerner Cubicles	IKBLC Commons	-.77887*	.26327	.011	-1.4054	-.1523
	IKBLC Silent Study	-.48561	.26772	.170	-1.1228	.1515

*. The mean difference is significant at the 0.05 level.

Appendix H

Tables on Correlations between Test Variables (Statistical Analysis from SPSS)

Table H1

Correlations between Reported Stress & Noise

		Reported Stress Level	Reported Noise Level
Reported Stress Level	Pearson Correlation	1	.314**
	Sig. (2-tailed)		.001
	N	101	101
Reported Noise Level	Pearson Correlation	.314**	1
	Sig. (2-tailed)	.001	
	N	101	101

**. Correlation is significant at the 0.01 level (2-tailed).

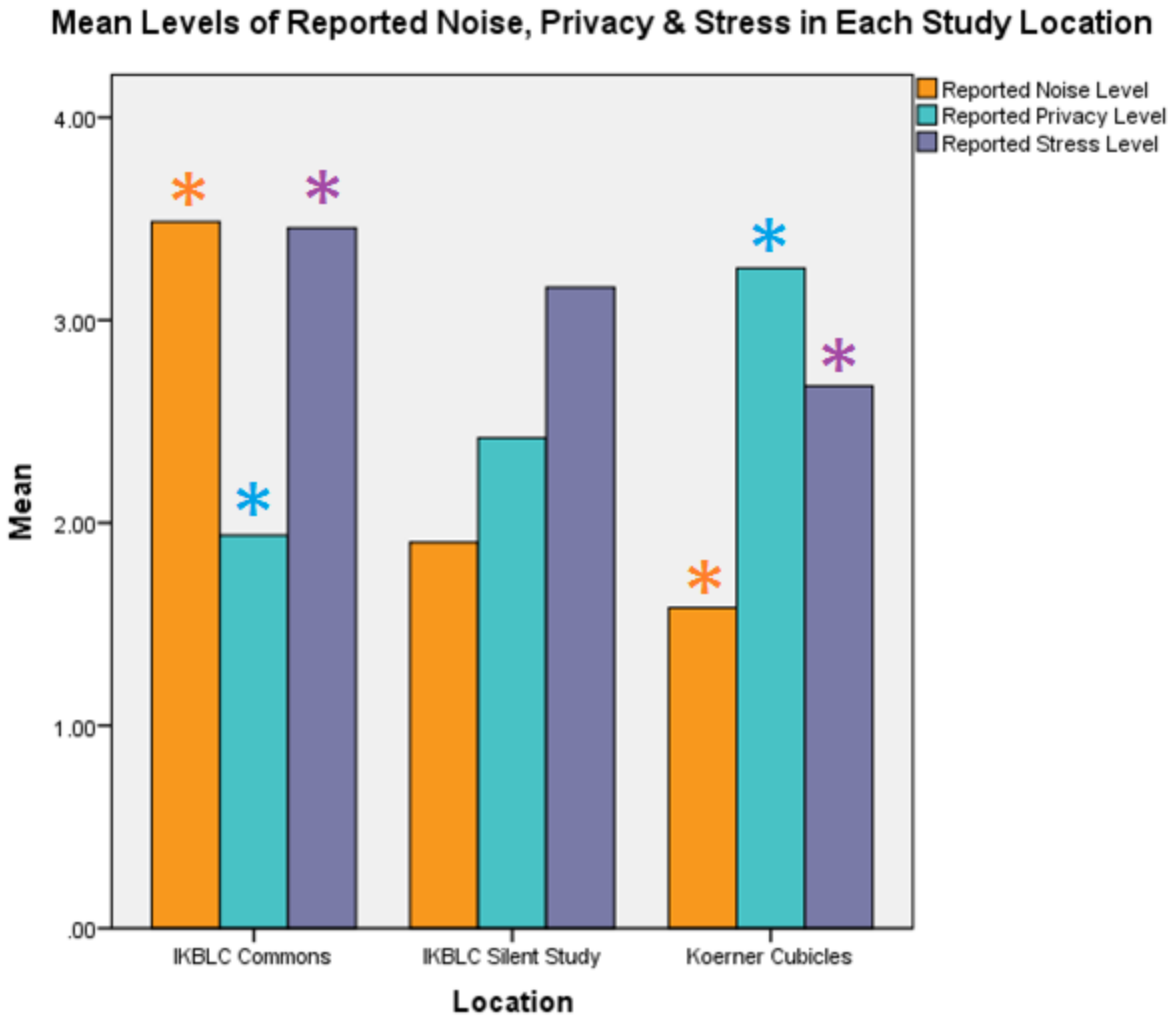
Table H2

Correlations between Reported Stress & Privacy

		Reported Stress Level	Reported Privacy Level
Reported Stress Level	Pearson Correlation	1	-.313**
	Sig. (2-tailed)		.001
	N	101	101
Reported Privacy Level	Pearson Correlation	-.313**	1
	Sig. (2-tailed)	.001	
	N	101	101

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix I


Mean Levels of Reported Noise, Privacy & Stress in Each Study Location
Reported Noise Level
Reported Privacy Level
Reported Stress Level
Mean
4.00
3.00
2.00
1.00
.00
IKBLC Commons
IKBLC Silent Study
Koerner Cubicles
Location