

Impact of Informal Study Spaces in the Nest on Student's Well-being and Cognitive Function

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PSYC 321

April 06, 2017

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Impact of Informal Study Spaces in the Nest on Student's Well-being and Cognitive Function

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Abstract

This paper focuses on the effect environment plays on students' well-being and cognitive functioning. In particular, our study concentrates on informal learning spaces located in The Nest on the campus of the University of British Columbia and how these spaces contribute to students' welfare and cognition. The results of our study show no statistical significance in the effect of environment on cognitive functioning or well-being. However, significance was found in how students rate the noise level of the various environments investigated. Our research points to further exploration in the noise level of environment and its' impact on students ability in cognitive functioning.

Introduction

Learning spaces are a key component in a students' ability to perform well academically as well as maintaining a stable well-being. Institutions have recently become more interested in how to improve these environments to enhance and support students' health and well-being (Stanton 2016). Most research has looked at the impact of formal learning spaces on students' academic outcomes. While in regards to informal learning spaces little research has been conducted to examine the effects the environment has on students' cognitive performance and well-being. Our study aims to examine five different informal learning spaces (knoll/steps, first-floor space, third-floor lounge, third-floor egg, and fourth-floor lounge) in The Nest at the University of British Columbia. Specifically, we explore how these individual informal learning spaces impact students' affect, self-authenticity, and cognitive functioning. We hypothesize that cognitive functioning will vary between the five different locations due to various noise levels while affect and self-authenticity will remain constant throughout. We predict the knoll and first floor will demonstrate lower cognitive functioning due to high foot traffic and noise, while the spaces on the third floor will be slightly higher, and the fourth-floor lounge was having the highest level of cognitive functioning due to low noise and crowd levels.

Participants

The AMS nest is located centrally at UBC and was designed as space for students to study, eat and interact with one another (About The Nest, 2017). Therefore, our target population for this study was the student demographic of UBC; that is inclusive of all faculties and specializations across campus.

Space	N	Male	Female	Other Genders	Age (Avg)	Undergraduates	Others (Visitors, etc)	Years at UBC
1st Floor Study	7	4	3	0	22.14	6	1	2.86
3rd Floor LVL	9	3	5	1	20.56	8	1	2.78
3rd Floor Pocket	8	5	3	0	19.88	8	0	2.38
4th Floor Pocket	6	0	4	2	21.00	5	1	3.00
Knoll	11	4	7	0	21.27	11	0	2.91
Sum	41	16	22	3		38	3	
Avg	8.2	3.20	4.40	0.60	20.97	7.60	0.60	2.78
%		39.02	53.66	7.32		92.68	7.32	

The majority students of students are aged in between 18 and 24, due to the sheer volume of undergraduate students, out of which 45% are male, and 55% are female (Demographics Overview, 2017). Our participant data reflected a slight variance from the population parameters. Our distribution had an age range of 18 to 30 years old. And the participant gender ratio consisted of 39.02% male, 53.66% female and 7.32% other. In addition to that our participant population was fairly acquainted to the University having spent an average of 2.78 years as part of the institution.

Measures

The survey was provided to us by Dr. Zhao, the Canada Research Chair in Behavioral sustainability and an assistant professor in the UBC Department of Psychology and The Institute of Resources, Environment and Sustainability.

Link to survey:

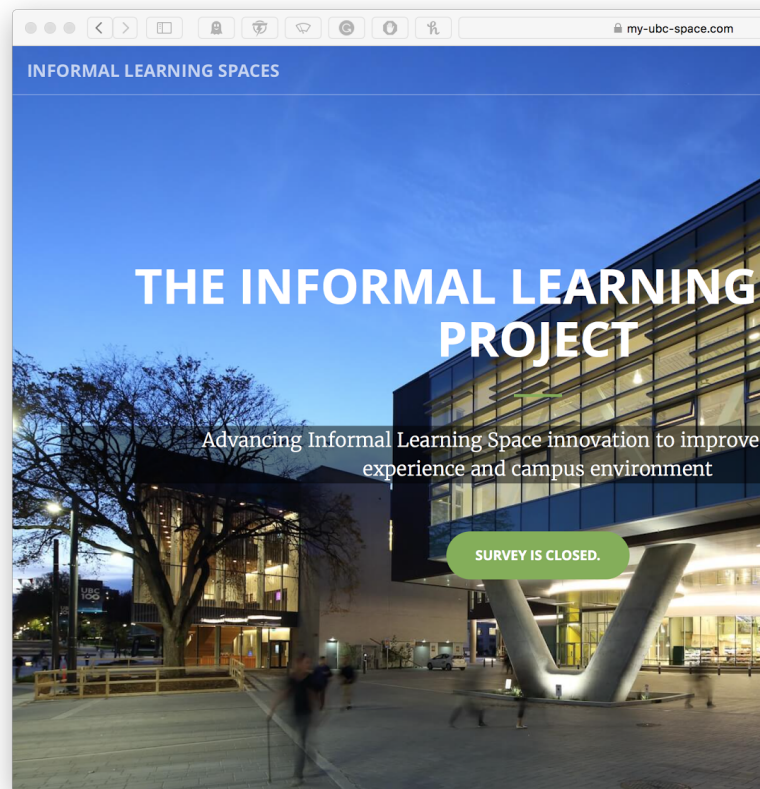
<https://my-ubc-space.com/quiz/preview>

The survey was developed by sensible building science as a part of the informal learning space project. A four way collaboration between the Alma Mater Society of UBC, Facilities planning (learning spaces team), UBC Department of Psychology and DIALOG.

Given the nature of the study and research we were unable to modify the survey and had to follow the standard format provided. The survey consisted of 80 questions and measured four aspects:

1. Self Authenticity
2. Affective States
3. Environmental Perception
4. Demographics

The first ten questions measured the sense of self-authenticity through a series of statements which participants had to rate on a scale of 1-7 on how authentic they felt in the space. One being least authentic and eight the most. To measure the affective state of our participants we used the Positive and Negative Affect Schedule (PANAS) that gave us an insight on 25 emotions. This was an untraditional use of the PANAS with only 25 emotions, as it usually contains 20 emotions (Watson et al. ,1988) or in the PANAS-X that consists of 60 (Watson, D & Clark, L, 2014). Environmental perception questions include measures such cleanliness, comfortableness, and noise level of the different spaces. The survey went into further detail to understand participant demographics. The questions explored factors such gender, age, status at UBC, the field of study and time spent at UBC.



Within those 80 questions, the concluding section of the survey consisted of cognitive tests. Questions 55 - 64 consisted of items that comprised of Raven's matrices test using a sets of stimuli organized on the basis of specific rules; one stimulus item was omitted, and the participant's task was to induce the rule and select the appropriate missing item from a set of six or eight alternatives (Rao, K. & Baddeley, A, 2013). There was no time limitation allotted to this and test remained relatively standard regarding complexity. The Raven's matrices allowed us to test the fluid intelligence within our participants. Following this a spatial working memory task was introduced to test working memory span. Lastly, a cognitive control task was used to test executive function.

Procedure and Conditions

Participants were approached at random in the five informal learning spaces located in the Nest and were asked to participate in the survey. Each of the five locations was representative of a different condition. Although participants were free to decline, as an extra incentive they were entered into a lucky draw from which they would win AMS Block Party Tickets (an annual music festival organized by the AMS Event, a department within the AMS of UBC), guestlist for the Pit (The AMS owned nightclub) and two \$25 AMS gift cards. The survey took approximately 20 to 25 minutes, after which the participants were entered into the lucky draw through a google document.

The Informal Learning Spaces were as follows:

1. Knoll Steps
2. 3rd Floor Egg
3. 1st Floor Lounge
4. 3rd Floor Lounge
5. 4th Floor Lounge

Please see Appendix A for maps and images.

Results

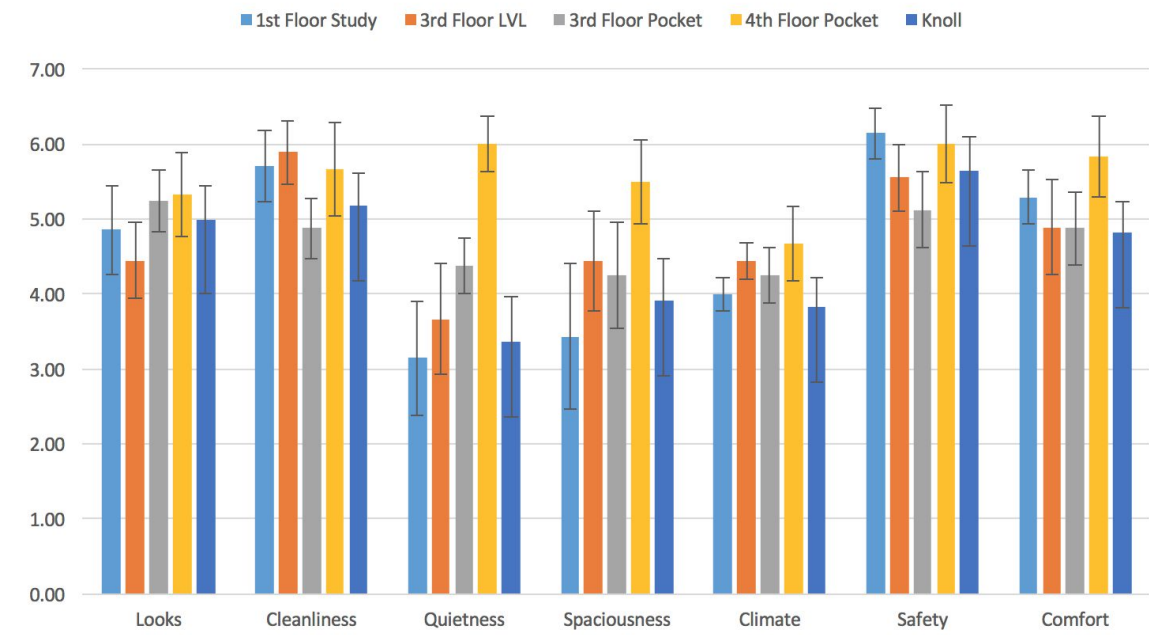
The results were based on complete data sets from 41 participants (N=41) from a total of 145 survey responses. The complete data set number was less than a third of the total survey response but due to technical issues (location not shared, etc.) and drop off rates due to the length of the survey. An example of that drop off can be seen in the 14 survey participants that completed the demographic and self-authenticity questionnaire however closed their browser at the cognitive tests and therefore were not counted as complete data sets.

From our complete data sets we had an average of 8.2 responses per space which is an extremely small sample size considering we were measuring variation in individual cognitive function in the different informal learning spaces. A one-way ANOVA was applied across all data sets of environmental perception, PANAS, self-authenticity and cognitive tests. Due the limiting factors mentioned above and elaborated up in the limitation section, we were unable to find any statistically significant differences between the spaces, except in the case of the environmental perception ‘quietness’. The individual tables showing the calculated ANOVA scores for all graphs can be found in Appendix B.

Environmental Perception

Looking at the graphed average means of the individual environmental perception categories across the different spaces, we can observe a slightly higher scoring associated with the 4th-floor pocket lounge. The environmental perception of quietness and spaces is the only statistically significant results obtained in the study (p-value: 0.02, 3.17 (f) > 2.63 (f crit)).

Enviromental Perception (By category)



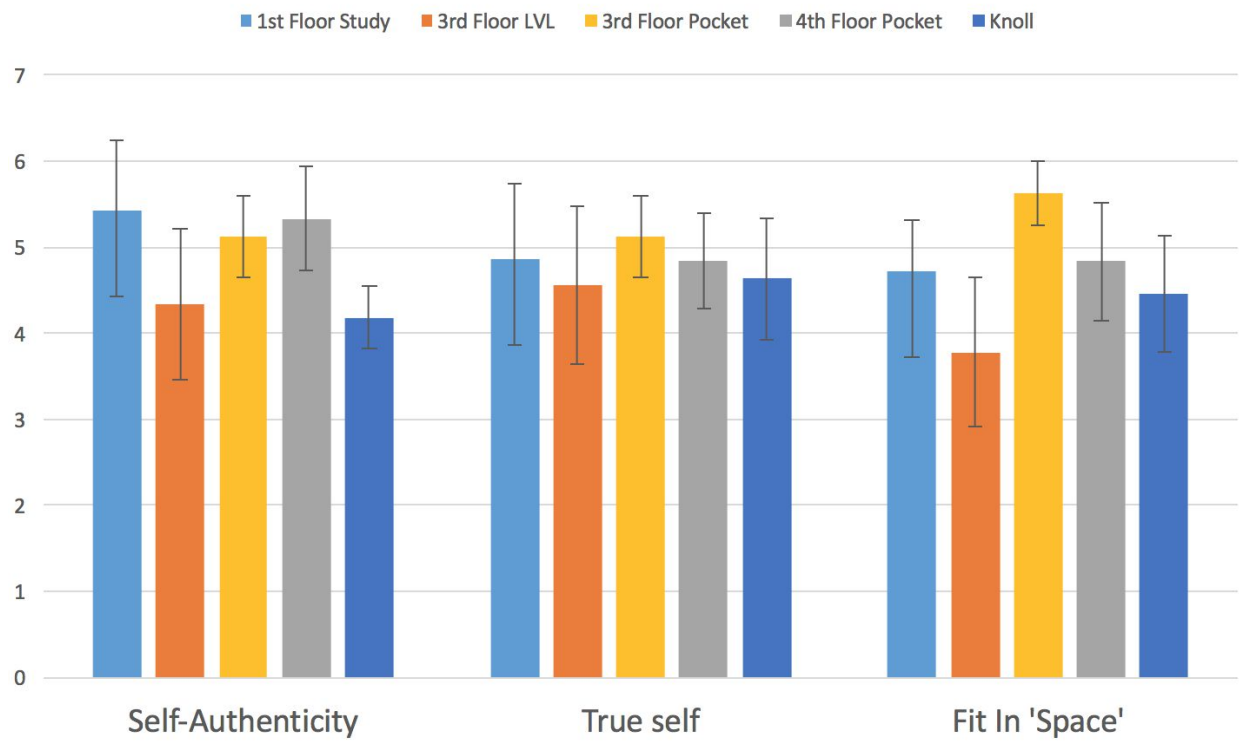
The environmental perception of quietness reflects the locations noise levels, which can be observed to be much louder in the 1st-floor study and Knoll locations. In comparison, the 4th-floor pocket Lounge is rated as far quieter. The only other environmental perception category that was close to being statistically significant was ‘spaciousness’ which was scored much higher in the 4th-floor lounge. This result is surprising as the 4th-floor lounge is one of the smallest ILS

in the study, however compounding factors of ‘quietness’ and ‘comfort’ could have resulted in that data.

Self-authenticity

Questions on the participants self-authenticity did not yield any statistically significant variance between the different spaces which was identified using one-way ANOVAs.

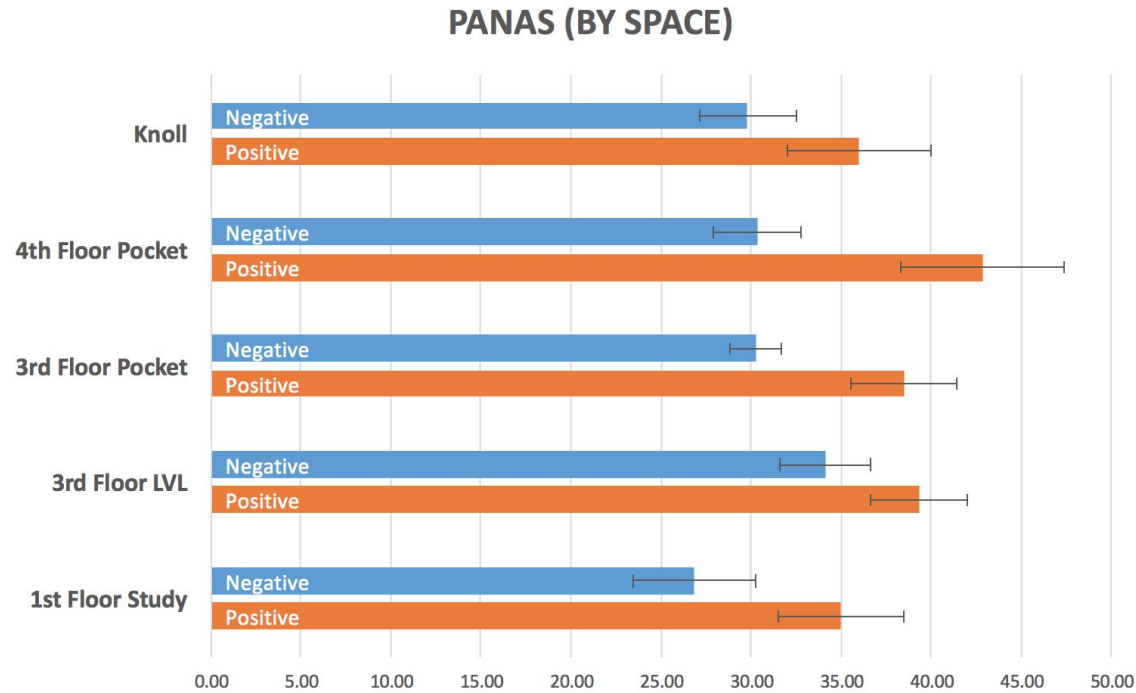
Self-Authenticity (by Category)



From the calculated mean cores we can visually determine that 3rd floor pocket lounge on top of the Performance Theater was perceived as having the best ‘fit in space’. Which might be reflective of it’s layout and provided furniture.

PANAS

Using a one-way ANOVA showed that there was no statistically significant difference across the negative scores and positive scores in the individual spaces.

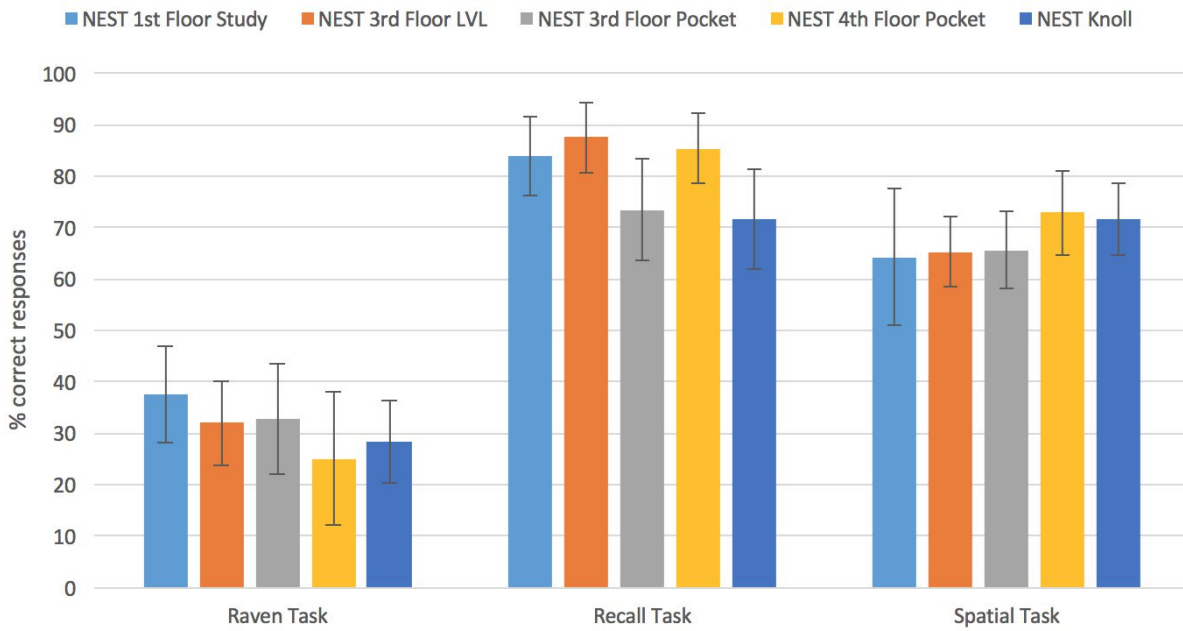


From a visual statistical point it can be observed that the order of highest to lowest positive affect is: 4th floor lounge, 3rd floor egg, 3rd floor lounge, knoll, 1st floor space. This shows is reflective of a previous theme identified of 4th floor having a positive impact on participants, however when we look at the order of scores in negative affect it is: 3rd floor egg, 4th floor, 3rd floor, knoll, 1st floor, which negates this assumption.

Cognitive function tests

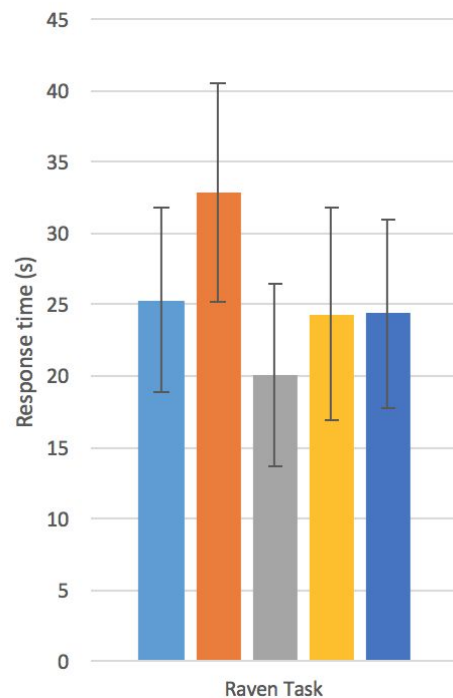
The cognitive tasks that were applied meant to assess if the different spaces impacted the cognitive functioning of the individuals participating in the study. To do so the % of correct responses and their response time was assessed individually. However, no statistically significant differences were found in the one-way ANOVA applied to all factors. The Raven’s matrices meant to test fluid intelligence by having participants complete a task in which they had to identify the missing element that completes a pattern. However, there was no statistical significance. The Spatial working memory task meant to test working memory span. A green ball flashed in different boxes and participant has to follow the pattern. However, this again yielded no statistical significance. The last cognitive control task tested executive function. Participants had to press 1 or 8 on the keyboard when the image flashed on left or right side of the screen. 1 for the left and 8 for the right and once this was completed then it switched from 1 to the right side of the screen or 8 for the left side of the screen.

Cognitive task: % of correct responses



From a visual analytics standpoint, it is clear that the Raven task was perceived as a far more difficult task and that the Recall task might have been too simple to complete. In addition to that, it appears that in the Raven Task the 4th-floor pocket lounge contributed to the largest variance in scores and the lowest average score. In the spatial task, the 1st-floor study space had the lowest average score and as well as the largest variance. Both of the observed results could be of interest for further investigation as the 4th-floor study lounge should allow people to be more at ease and therefore perform better at the complex raven task whereas individual on average performed much more than 10% better in the 1st-floor study space. In regards to the spatial task, this results is exactly the opposite from a visual standpoint. However, this variance could be explained by between-subject variance.

In regards to the response time for the Raven task (shown on the right) it is clearly visible that the 3rd-floor study space had a much faster response time than the nearby 3rd-floor pocket lounge. In the spatial task, there was virtually no difference in response time between the spaces.



Discussion

After extensive analysis of the results, it is clear that we did not collect statistically significant data likely due to the small sample size of the study. The only statistically significant factor we could discern was the quietness of the environments. Which therefore nullifies our hypothesis, since we believed that there would be significant variability in the cognitive function and consistent levels of affect, and self-authenticity.

Limitations

There were a few limitations that impacted the results of our study and could be part of the reason we did not find much statistically significant data. The main limitation was the sample size. While initially data was collected from over 80 participants, only 41 were viable for analysis. The period during which the survey was distributed is the most hectic and stressful for students, which meant fewer individuals were willing to participate. Which ties into the next issue, which is the length of the survey. It took roughly 20 minutes to complete the survey, as mentioned above this is a highly stressful period, and not many people had 20 minutes to dedicate to a survey. Furthermore, with many of the participants, we encountered software malfunctions, where the survey crashed and could not be finished, which further shrunk our sample size since participants often did not have the time to start over. Participants also experienced interruptions in the survey due to wifi issues. During peak hours there are roughly 25 000 students in the Nest, which results in the wifi being overwhelmed. Initially a raffle with ten iPod as a prize was used as an incentive, however, this quickly became clear that this was ineffective. To increase the incentive, the raffle was expanded to include five block party tickets, five pit guest-lists and 2 AMS food gift cards worth 25\$ each. An additional useful incentive to increase the sample size could have been to have students complete this survey for HSP credits. The combined effect of these issues, severely impacted our sample size, which in turn limited the data we could gain to analyze. Another limitation is the fact that the data is based on self-report, which means that it is susceptible to response bias. Participants may have felt pressured to answer in a way they believed was appropriate, instead of answering completely truthfully. There is also the issue of Participant bias due to the selection process. Since participants were randomly selected by approaching them in the pre-determined study areas, there is a bias in whom was approached, to begin with. Students that seemed very stressed and busy were overlooked in favor of individuals who seemed more approachable. Lastly, the survey failed to control for the participant's preference of study environment.

Implications and further research

Given the lack of statistically significant data found in this study, we would recommend the study be redone with a few changes to gain the information required to improve the informal study spaces around UBC campus. The survey should be significantly shortened, and the software issues resolved before the study is redone. It should also be conducted over a much longer period, so that one can control for academic stress as well as the impact of weather on the individual's affect. Conducting this survey over a much longer period would also allow for a larger sample size to be collected. A larger sample size would also mitigate the effects of participant bias. Incorporating HSP credit would also further reduce the participant bias effect. The information deduced from the data of this survey could have a long-lasting effect on the quality of informal study spaces on campus. Not all students chose to study in libraries. Thus the option of well designed informal study spaces is also critical to student's academic success. Furthermore, information gained from this study could be implemented on a wider scale to other universities and even used in the design of office spaces.

Recommendation to Client

Our goal for this study was to discern the differences in affect, self-authenticity and cognitive function between 5 predetermined informal study spaces in the AMS Nest. Based on our results, we recommend that should UBC decide to designate the first-floor study space and the Nest Knoll as informal study spaces; they should explore ways to reduce the noise levels. These two areas exhibited the highest noise levels as well as the highest foot traffic. This recommendation falls in line with the conclusions drawn by Klitzman and Stelman (1989), stating that the physical environment, such as noise pollution has an effect on psychological well-being. However, given our overall results, it is also our recommendation that the study is redone, with the modifications specified in the discussion. A larger sample size will most likely lead to statistically significant data, which in turn could significantly impact the quality of the informal study spaces on campus available to UBC students.

Citations

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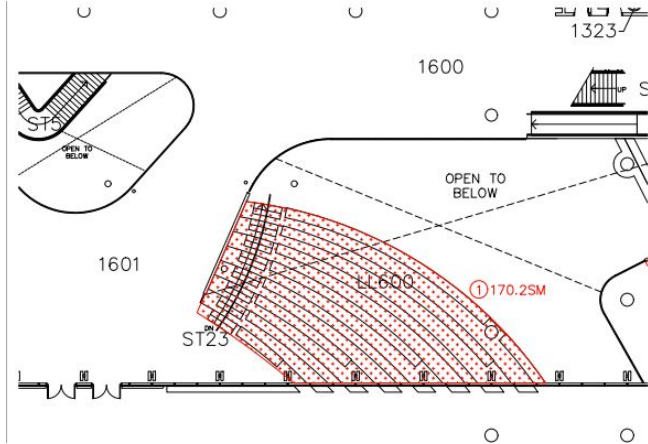
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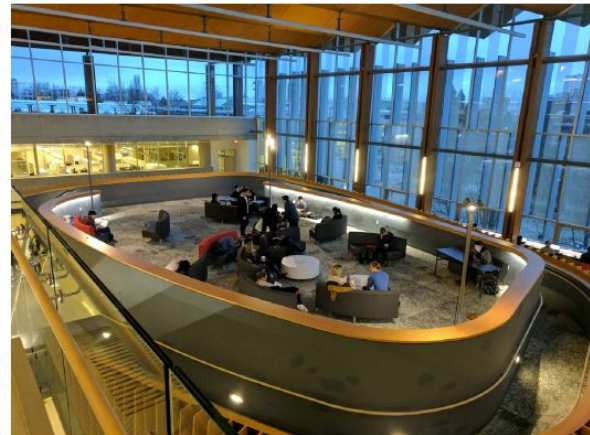
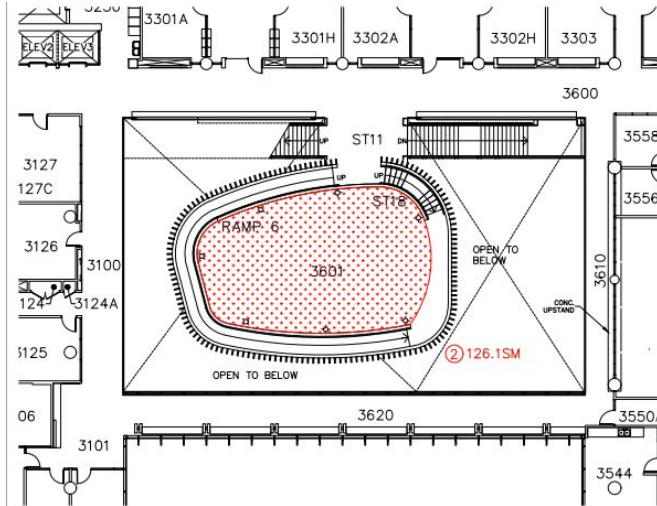
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Appendix A
Informal Learning Spaces location maps and images

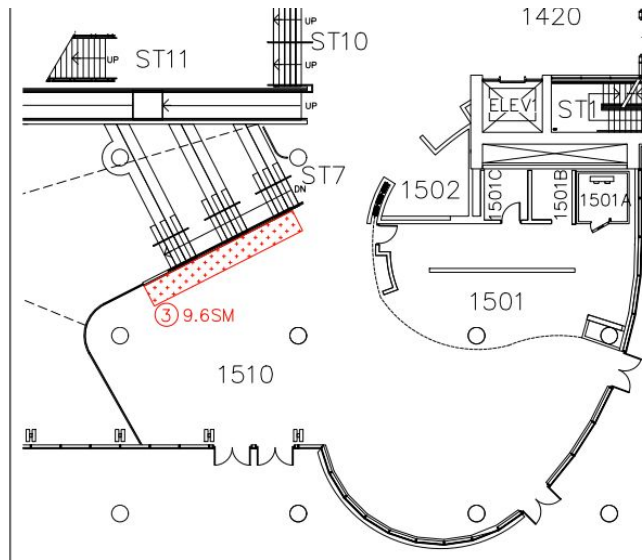
Knoll Steps



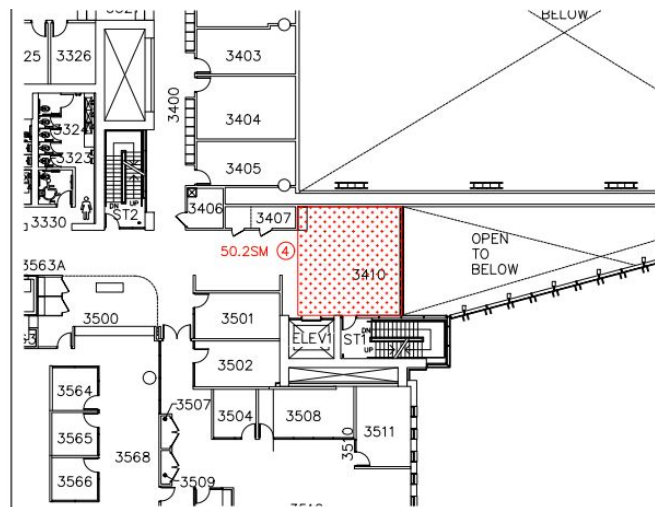
3rd floor egg



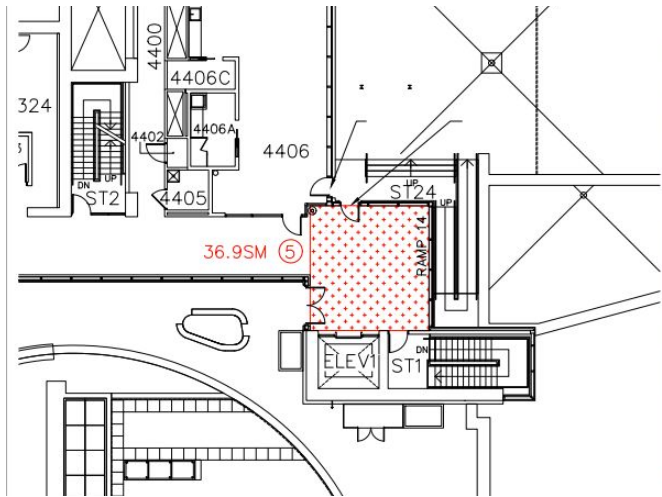
1st floor lounge



3rd floor lounge



4th floor lounge



Appendix B**ANOVA results by study spaces***Environmental Factors*

	F	P-value	F crit
Comfort	0.68	0.61	2.63
Safety	0.75	0.56	2.63
Climate	1.03	0.40	2.63
Spaciousness	1.07	0.38	2.63
Quietness	3.17	0.02	2.63
Clean	0.95	0.45	2.63
Looks	0.54	0.70	2.63

Self-authenticity

	F	P-value	F crit
Fit in Space	1.25	0.31	2.63
True-Self	0.11	0.98	2.63
Authenticity	0.89	0.48	2.63

PANAS

	F	P-value	F crit
Positive	1.38	0.26	2.63
Negative	0.60	0.66	2.63

Cognitive Tests - % correct responses

		F	P-value	F crit
Raven	<i>Correct Responses</i>	0.2	0.93	2.63
Recall	<i>Correct Responses</i>	0.74	0.57	2.63
Spatial	<i>Correct Responses</i>	0.21	0.93	2.63

Cognitive Tests - Response times (s)

		F	P-value	F crit
Raven	<i>Response Time</i>	0.46	0.77	2.63
Spatial	<i>Response Time</i>	0.96	0.44	2.63

Appendix C

Overall mean averages used for visual analytics

Environmental Perceptions

Space	Look	SE	Cleanliness	SE	Quietness	SE	Spaciousness	SE	Climate	SE	Safety	SE	Comfort	SE
1st Floor Study	4.86	0.59	5.71	0.47	3.14	0.77	3.43	0.97	4.00	0.22	6.14	0.34	5.29	0.36
3rd Floor LVL	4.44	0.50	5.89	0.42	3.67	0.75	4.44	0.67	4.44	0.24	5.56	0.44	4.89	0.63
3rd Floor Pocket	5.25	0.41	4.875	0.40	4.375	0.38	4.25	0.70	4.25	0.37	5.125	0.52	4.875	0.48
4th Floor Pocket	5.33	0.56	5.67	0.61	6.00	0.37	5.50	0.56	4.67	0.49	6.00	0.52	5.83	0.54
Knoll	5.00	0.45	5.18	0.44	3.36	0.59	3.91	0.57	3.82	0.41	5.64	0.46	4.82	0.41

Self-authenticity

Space	Self-Authenticity	SD	SE	True self	SD	SE	Fit In 'Space'	SD
1st Floor Study	5.43	0.98	0.37	4.86	1.86	0.70	4.71	1.80
3rd Floor LVL	4.33	1.80	0.60	4.56	1.67	0.56	3.78	2.05
3rd Floor Pocket	5.125	1.36	0.48	5.125	1.36	0.48	5.625	1.06
4th Floor Pocket	5.33	2.25	0.92	4.83	2.14	0.87	4.83	2.14
Knoll	4.18	2.14	0.81	4.64	2.34	0.88	4.45	1.57

PANAS

Space	Positive	SD	SE	Negative	SD	SE
1st Floor Study	35.00	9.06	3.42	26.86	9.21	3.48
3rd Floor LVL	39.33	7.47	2.49	34.11	8.07	2.69
3rd Floor Pocket	38.50	3.96	1.40	30.25	8.29	2.93
4th Floor Pocket	42.83	5.95	2.43	30.33	11.15	4.55
Knoll	36.00	7.07	2.67	29.82	10.48	3.96

Cognitive tasks - Raven Matrices

Space	Raven Task (% correct)	SD	SE	Raven Task (response time (s))	SD	SE
NEST 1st Floor Study	37.50	25.00	9.45	25.32	17.14	6.48
NEST 3rd Floor LVL	31.94	24.30	8.10	32.88	22.96	7.65
NEST 3rd Floor Pocket	32.81	29.76	10.81	20.06	18.85	6.42
NEST 4th Floor Pocket	25.00	31.62	12.91	24.35	18.31	7.47
NEST Knoll	28.41	26.86	8.10	24.37	32.16	6.60

Cognitive Tasks - Recall & Spatial

Space	Recall Task (% correct)	SD	SE	Spatial Task (% correct)	SD	SE	Spatial Task (response time (s))	SD	SE
NEST 1st Floor Study	83.93	20.04	7.58	64.29	34.93	13.20	3.70	0.64	0.24
NEST 3rd Floor LVL	87.50	20.73	6.91	65.28	20.52	6.84	3.55	0.60	0.20
NEST 3rd Floor Pocket	73.44	30.13	9.86	65.63	18.90	7.38	4.36	0.64	0.67
NEST 4th Floor Pocket	85.42	16.61	6.78	72.92	20.03	8.18	4.08	0.56	0.23
NEST Knoll	71.59	32.16	9.70	71.59	23.11	6.97	3.71	0.42	0.13