Redesign to Relieve the Crowdedness
at Cohon University Center

Introduction

Many students choose to lunch at Cohen University Center (CUC) of Carnegie Mellon University (CMU), resulting in the building to be very crowded, and the seats on high demand. The goal of this study is to identify why CUC is so crowded, and how we can redesign the system to help students who want to eat at CUC find their seats easily.

Background

Environment. CUC is located at the center of the Carnegie Mellon University campus. It contains many important infrastructures, such as meeting rooms, bookstores, post office, gym, and, most importantly, dining services. There are 12 dining locations available to students during the lunchtime, with a certain degree of diversities.[1] The dining places are mostly located at the second floor of the building, with only one cafeteria and one convenience shop located on the other floor.

The seats are never "affiliated" with one dining place: seats are scattered around the building, but mostly concentrated at the second floor, near the restaurants. Most seats are small tables with two or three chairs; there are also big tables with six or eight chairs; there are tall bar tables, too, but only on the first floor.

Many places have wall plugins free to use. There is no background music played at the dining location, but some have muted televisions installed, with remote controls available for students.

Block System. In fall 2017, 1670 students enrolled in as CMU's first year class, all of which are forced to pick their dining plans from four different prepaid plans. Among the four plans, unless students live in a dorm equipped with a kitchen, they are supposed to eat at least 24 meals per two weeks on campus, plus $800 dollars as their flexible dollar. When a new two-week cycle starts, the dining service will clear all the unused meals (called "blocks") and reimburse new blocks for the next cycle. This system is mainly for the freshman to get used to their campus life.

Schedule. For undergraduate students, CMU typically schedule 3 hours for each class. Some classes are taught on Monday, Wednesday and Friday only, with one hour on each day. These classes typically starts at the middle of an hour, and ends at 20 minutes past the next hour (i.e., from 8:30 to 9:20, from 11:30 to 12:20, etc). The other classes, taught on Tuesday and Thursday, typically span 1.5 hours per lecture. These classes would span from 9:00 to 10:20, then 10:30 to 11:50, 12:00 to 1:20, so and so on. Note that no matter which day of the week it is, usually students get 10 minutes between lectures, so that they have enough time to hurry to the next classroom. With this schedule, CMU's typical lunchtime peaks would start from 11:30, 12:30 and 1:30 on Monday, Wednesday, and Friday, and 12:00 on Tuesday and Thursday.

There are many construction sites around the campus, and sometimes the workers would also visit the dining places and grab a food to eat.

Method

Before jump right into the redesign of the system, the designer interviewed two students for user studies to help with the task analysis. After that, the designer composed a fault tree analysis for the root cause of this systematic problem, as well as the human factors involved. From there, the designer redesigned the system.

Task Analysis

To better understand the seatings, two CMU students were randomly selected during the lunch peak time. To minimize the disturbances, both students managed to find a seat somewhere in the CUC, were eating alone, and had almost finished their lunch.

The designer interviewed each student for around 5 minutes. The questions include a think-out-loud about their lunch experiences at CUC today (from the decision making to when to leave the seat), as well as background information survey (for the transcript of this interview, please check the appendix).

The second interviewee is selected as an example in this lunch task analysis.

Settings

Environment: CUC (started at the classroom, ended up picking up the lunch at the second floor of CUC, and had the meal at the first floor)

Time: Around 12:20, November 14th (Tuesday)

People involved: A male student, mechanical engineer major, first year; the students' friend, with whom the students dined with.

Devices: None.

Steps

I. Decide where to eat for the lunch.

    A. Decide what kind of food to have for the lunch.

        1. The subject finds himself looking for food that are lighter and fast, and thus decides to visit a salad place.

    B. Decide which restaurant to eat from.

        1. The subject would like to use up a block, so he visits the salad place.

II. Grab the lunch.

    A. The subject stays in the line.

    B. The subject decides their salad content.

    C. The restaurant stirs the salad it in front of the subject

    D. The restaurant gives the salad to the subject.

    E. The subject pays the restaurant with a block.

III. The subject walks around to seat themselves.

    A. The subject walks towards where they think would have the most empty seat during the lunch time.

        1. The subject looks around at the second floor to see if there is any empty space around.

            a) Error: no space found.

      2.   The subject decides to go to the dining space next to El Gallo de Oro, because the seat is usually available there.

  B. The subject spots his friends eating at El Gallo de Oro.

      1.   The subject decides to join their table.

IV. The subject finishes his lunch.

  A. The subject finishes his lunch while spending time with his friends. His friends finish their lunch, too.

  B. The subject's friends leave.

      1.   The subject decides to stay and do homework there, because it is less sleepy with this crowd of people sitting around.

User Study

Aside from the interview, the designer conducted two additional surveys. The designer counted the number of people seated during the peak time, and the number of students enter the CUC in a particular day (Check the appendix for the result). Based upon the interviews, the results from the survey, and the background information to the meal dining services, the designer conducted the following fault tree analysis:
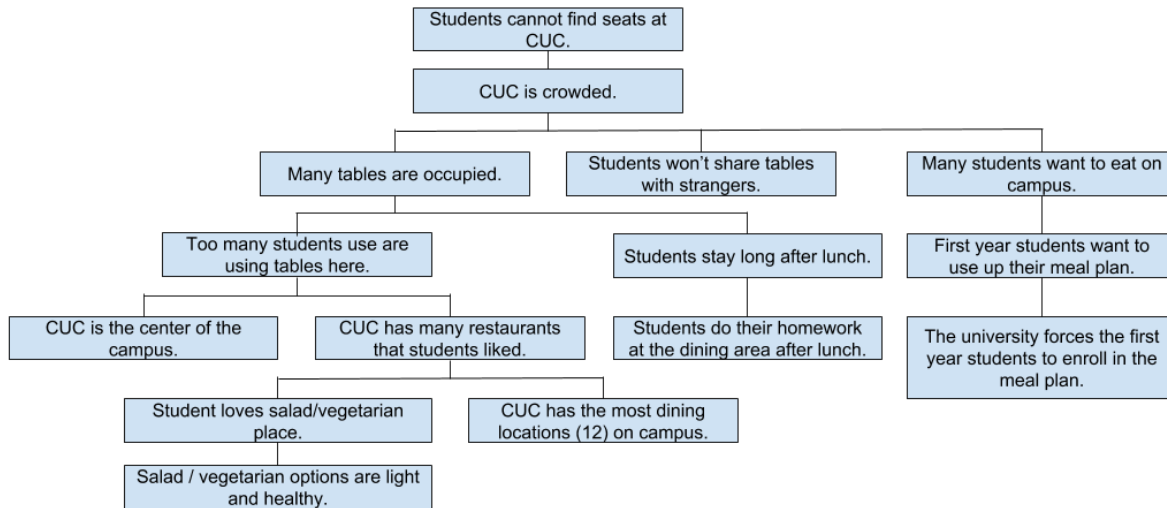
Problem identified

Gather all the tree leaves above, the designer find the following root causes that prevent students who want to eat at CUC to find a spot:

1. The university forces the first year students to dine on-campus through the meal plan system.

2. CUC has the most dining options across campus.

3. Students are attracted by the healthy and lite food at CUC.

4. CUC is located at the center of the campus, and is the most convenient place to go.

5. Students may stay longer to finish their homework.

6. Students are usually too timid to share their tables with the strangers.

Among the six root causes, the designer only consider three of them to be redesign-able. #1 is both good for the first year students to learn about the campus, and is also a very important financial income for the dining services. #2 is also not likely to get changed, because in general, the allocated dining location is not likely to change, or decrease. #4 is not likely to change, either. The CUC building won't move. So the designer would like to focus on #3, #5 and #6.

Redesign

The designer would like to relief the crowdedness problem by focusing on #5 and #6. Specifically, the designer would like to add background noise and bar table at the second floor of CUC, to increase the turnover and the table usage.

Background Music

To shorten the time students spend sitting at the table doing their homework, we need to create an environment that is only suitable for eating and nothing more, so that students would finish their lunch as they normally would and leave, empty out the spot for the next student to use. The designer suggests adding some background noise during the peak time.

Specifically, the designer would like to add some background music to the dining environment during the peak time, starting from 11:00 to 2:00. Eating does not require much cognitive load; however, many other tasks, such as working on homework, remote video call, do require people to concentrate. Here, the background music would become a disturbance degrades speech understanding, and drives them away. Besides, this would work better if the musics are pop songs with lyrics. Due to the natural top-down processing, people would quickly pickup the lyrics, which occupies their mind, and increase the disturbances for non-eating tasks.[4] Furthermore, studies have shown that loud and fast-paced music would significantly results in short stays, and faster turnovers. [6]

The trade-off is that the staff at the dining area may suffer from hearing loss. The peak hour usually lasts for 2 hours.[5] Then by OSHA's standard, the sound level shall not go beyond

100 dBA. [4] However, research has shown that for people under 30, the maximal sound level should be around 75 - 79 decibels, so the sound level should not be a huge problem.
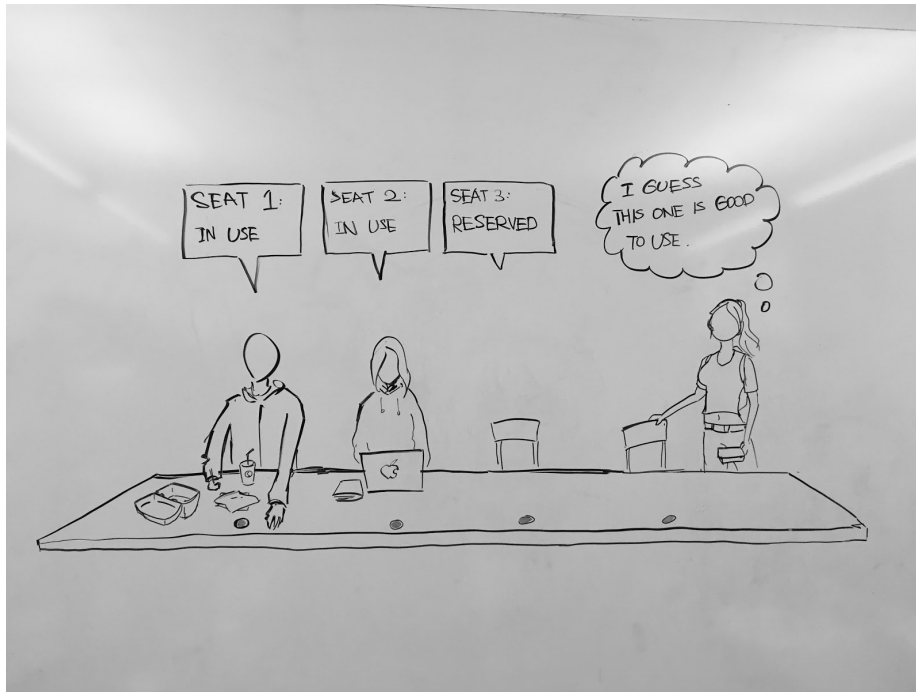
Bar table

Because of people's natural tendency to "defend their private space", many students find it awkward to share their table with strangers, or ask a stranger for table sharing. Typically, people would sit at a separate table, or, if people agree to do the table sharing to be polite, avoid eye-contact, or set up a boundary with readings or electronic devices.[7]

The picture on the right shows the typical small table setting on the second floor of the CUC. Usually there are around one third of the students sitting by themselves (see the appendix), which means, in this setting, wasting 2 seats all at once.

The designer hereby proposes that the university changes the small round to "bar tables" with tall chairs (see the picture below). Students will all be facing the lifted empty space to avoid the eye-gazing at each other, so that the violation of the private sphere no longer exists., and the threshold of table sharing will be easier. Furthermore, now that students can see the entire dining space instead of simply focusing on their little dining table, it extends their perception to the entire dining space. During the peak time, students would become more aware of the overly crowded dining area, which would drive them to leave.[6]

The trade-off of table sharing, aside from the cost, is that "unacquainted customers are put into a situation where there are plenty of opportunities to initiate a conversation"[7] and thus elongates their time spent on dining.

Conclusion

After user studies and researches, the designer proposes two ideas: the use of background music and the bar table, in order to speed up the table turnover, and invite the students for table sharing. The two methods should both be effective at a relatively low cost.

Appendix

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User study transcript

Interview 1

12:02 @CUC floor 2 near the rotunda(?), salad
Describe how do you have lunch, from deciding where to eat, to find the seat and sit down ?
Just decided to eat at the Vegetarian place, because she is vegetarian and the line is short. -> Go for it.
Why eating at CUC?
Short line. Vegetarian. Came here ~ 15 min ago. Go to the pool, then look around. Not aware of the basement.
Is it hard to find a seat?
Yes.
Do you usually work here?
The student does not work here today, but generally they would stay here for a while
I notice that despite the fact CUC is very hard to find the seat, you still manage to find a seat here. So how long have you been here? And how long do you usually stay?
15 minutes. Depends - if no work, then leave soon.
How often do you visit here? With your friends? How often do you consider the other dining locations, such as resnik?
Not quite often - 70% dining at
Occasionally take away, but mostly eat here.
50% Alone, 50% with the others.
Age? Are you an undergrad or grad? Enrolled in blocks or not?
17. Freshman. Using red 9 as the meal plan.

Interview 2

12:20 @ El Gallo de Oro eating space, salad
Describe how do you have lunch, from deciding where to eat, to find the seat and sit down ?
Came here, grab the lunch from the salad space because it is healthy, lite and fast. Swing by knowing that the location next to the mexican food place is typically empty there. See friends there. Sit down and lunch with them together. Friends gone, but he decided to do his work here, because it is convenient to do so. Usually at dorm, but this place does not make him feel sleepy.

Why eating at CUC? Other places like Resnik? You don't go there because you are not aware of them, or you simply enjoy what you have right now for food?
At CUC because closer to the class. Mechanical engineer, and classes usually at doherty, wean. 80% at CUC, 20% at Exchange. Made this decision because he started with a map of all dining locations, and consider these two to be the best.

I notice that despite the fact CUC is very hard to find the seat, you still manage to find a seat here. So how long have you been here? And how long do you usually stay?

Has been here 40-50 minutes. Not sure how long he will stay here -- just staying there and do work. Usually also around 40-50 minutes.

Age? Are you an undergrad or grad? Enrolled in blocks or not? Does this influence your decision for lunch?
17; freshman. Red plan… but forgets which one. Yes. Blocks give broad options across the campus.

Statistics: How many students visit CUC during lunch time compared to Resnik?

The number of students walk into CUC building vs. number of students walk into Resnik building on the same day of the week (Thursday). As we can see, from 12:00 to 12:05, CUC has 117 visitors compares to Resnik, which only has 29.
10/26/2017 Thursday, CUC
11:55 39
11:57 37
11:58 29
11:59 29
12:00 21
12:01 14
12:02 13
12:03 24
12:04 4
12:05 5
11/2/2017 Thursday, Resnik
(takes me 10 minutes to walk there)
12:00 11
12:01 7
12:02 2
12:03 4
12:04 2
12:05 3

Statistics: How many students sit by themselves during the lunch time?

On 10/26 during the lunchtime, at the second floor, there are:
- 62 people sitting at the rotunda area, among which 21 were sitting by themselves.
- 58 people sitting by the swimming pool above the Entropy store, among which 18 were sitting by themselves.
- 11 people sitting next to the gym, 9 of which were sitting by themselves.

In total, around 37% of the students would eat by themselves.