Meta Tool

Spatial Programming Language&
Operating Manual

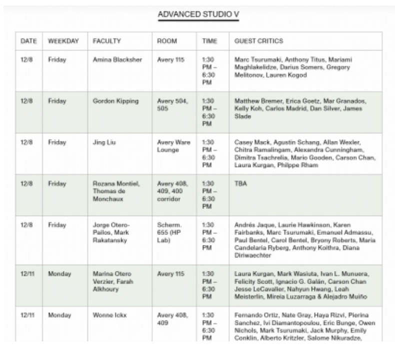
Individual work by Yilin Wang


EXIT


Introduction

We are all aware that during the final review week at Columbia University's Graduate School of Architecture, Planning and Preservation (GSAPP), the atmosphere is incredibly busy. Various programs and studios organize their final reviews, offering a prime opportunity for academic exchange and celebrating the culmination of projects. However, Avery Hall at GSAPP has a very limited area, which poses challenges in accommodating all studios for simultaneous reviews in a large, shared space - a contrast to practices at other architectural schools such as Harvard's GSD. This spatial constraint could potentially have a negative impact on academic innovation and exchange within Columbia's architecture programs.

Figure1. One AAD studio final review in 2023fall in 505 small classroom; The door is closed and environment is quite private



ADVANCED STUDIO V

DATE	WEEKDAY	FACULTY	ROOM	TIME	GUEST CRITICS
12/8	Friday	Amina Blacksher	Avery 115	1:30 PM – 6:30 PM	Marc Tsurumaki, Anthony Titus, Mariami Maghlakelidze, Darius Somers, Gregory Melitonov, Lauren Kogod
12/8	Friday	Gordon Kipping	Avery 504, 505	1:30 PM – 6:30 PM	Matthew Bremer, Erica Goetz, Mar Granados, Kelly Koh, Carlos Madrid, Dan Silver, James Slade
12/8	Friday	Jing Liu	Avery Ware Lounge	1:30 PM – 6:30 PM	Casey Mack, Agustin Schang, Allan Wexler, Chitra Ramalingam, Alexandra Cunningham, Dimitra Tsachrelia, Mario Gooden, Carson Chan, Laura Kurgan, Philppe Rham
12/8	Friday	Rozana Montiel, Thomas de Monchaux	Avery 408, 409, 400 corridor	1:30 PM – 6:30 PM	TBA
12/8	Friday	Jorge Otero-Pailos, Mark Rakatansky	Scherm. 655 (HP Lab)	1:30 PM – 6:30 PM	Andrés Jaque, Laurie Hawkinson, Karen Fairbanks, Marc Tsurumaki, Emanuel Admassu, Paul Bentel, Carol Bentel, Bryony Roberts, Maria Candelaria Ryberg, Anthony Koithra, Diana Diriwaechter
12/11	Monday	Marina Otero Verzier, Farah Alkhoury	Avery 115	1:30 PM – 6:30 PM	Laura Kurgan, Mark Wasiuta, Ivan L. Munuera, Felicity Scott, Ignacio G. Galán, Carson Chan Jesse LeCavalier, Nahyun Hwang, Leah Meisterlin, Mireia Luzarraga & Alejadro Muiño
12/11	Monday	Wonne Ickx	Avery 408, 409	1:30 PM – 6:30 PM	Fernando Ortiz, Nate Gray, Haya Rizvi, Pierina Sanchez, Ivi Diamantopoulou, Eric Bunge, Owen Nichols, Mark Tsurumaki, Jack Murphy, Emily Conklin, Alberto Kritzler, Salome Nikuradze,

Figure2. Review Schedule for AAD studios about time, location, critics. All of location are private meeting rooms

Spatial Programming Language

Conceptual Intent

In exploring Avery Hall, I identified a sizable communal area that could potentially serve as an excellent venue for simultaneous final reviews for multiple studios. This space is Avery Basement 100. Currently, it functions mainly as a shared space where students engage in activities like coffee breaks, solitary study, or group discussions, implying that its utilization isn't maximized. The 'spatial programming language' of this project involves devising a protocol that transforms the current Avery Basement into a dynamic review space. This transformation isn't static but adapts based on input parameters such as the number of studios, student count, etc. In essence, this parametric model is designed to offer a variety of design spaces, catering to the diverse needs of each review session.

Figure3. The current situation of Avery basement 100

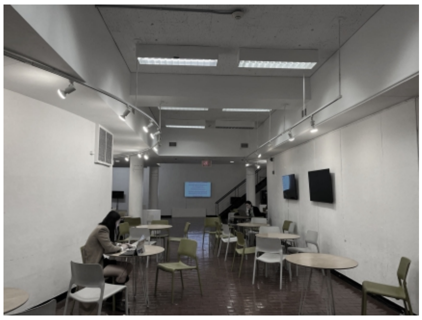


Figure4. The current situation of Avery basement 100

Conceptual Intent

Prior to proposing a specific spatial programming language, I conducted a SWOT analysis of Avery Basement. One potential disadvantage is its proximity to a coffee machine, which could be a source of distraction during reviews. The space is connected to key areas such as the Wood Auditorium and Room 114, with basement providing critical circulation. Therefore, in designing a review area within the basement, it's crucial to consider the creation of a circulation buffer zone to facilitate smooth movement and minimize disruptions.

The project user is the administration of GSAPP, who is responsible for managing the resources and facilities of the school. By applying an automated system, it would be easier for them to identify the most efficient and effective way to organize reviews and exhibitions for diverse options.

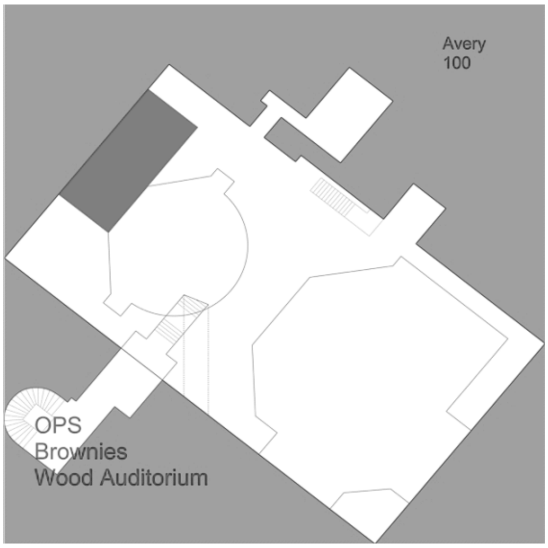


Figure5. The plan layout of the first floor of Avery

Spatial Programming Language

Methodlogies

Based on the conceptual idea, I propose a four-step process:

1.Collect input information and calculate **maximum wall space** for **each student**

2.Determine **class boundary** based on proximity to the walls.

3.Apply **view angle, standard deviation** and **visibility**(intersection with columns) as **metrics** to **measure the performance** for each design option.

4.Generate dynamic options and provide them to users based on different design space(parametric such as number of classes, student numbers in each class etc).

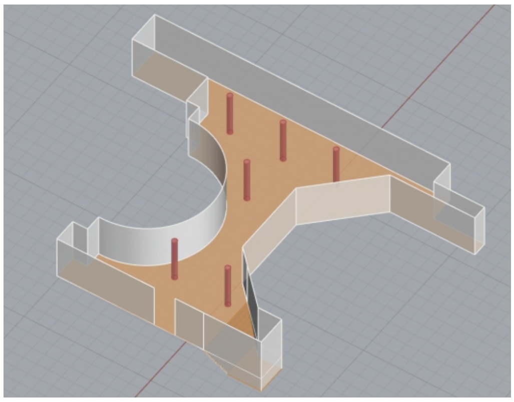


Figure6. model of avery basement, including boundary walls, stairs to wood auditorium, and columns

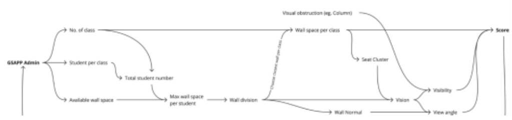


Figure7. diagram of methodologies

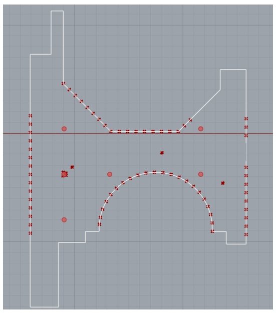


Figure8. Step1

Procedural Modelling Set up

1.Calculate the total number of students by multiplying the Number of Classes and Student Number per Class inputs; And then divide this value by total length of the wall.

2.Draw a class boundary(green curve) and populate cluster center based on the studio numbers.

3. With walls divided and cluster points selected, I measured the distance between the middle point of each wall segment and each of the cluster points, and connected the middle points to their closest cluster points.

4.Populate points around cluster points based on number of connection lines of each point, and randomly place chairs on those points, then rotate them randomly.

5. Visualize poster walls based on variation of studios.

**All the set up procedures are done in rhino and grasshopper.

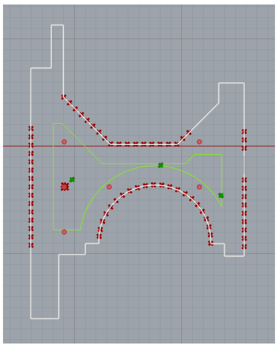


Figure9. Step2

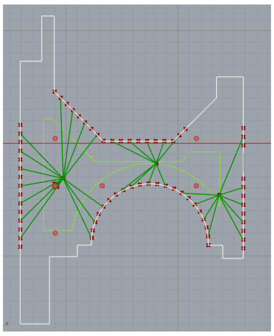


Figure10. Step3

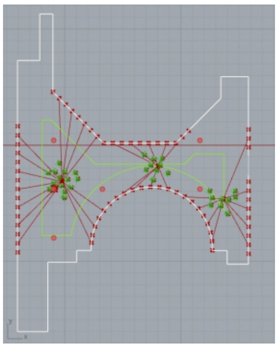


Figure11. Step4

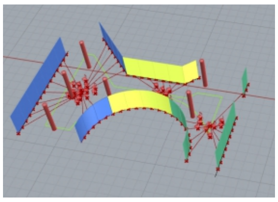


Figure12. Step5

Metrics Set up

1.Calculate the angle between the visual line and normal line as θ. A smaller value of θ indicates better visibility for the jury.

2.calculate lines in a cluster intersect with columns, the average intersections are documented and counted. The smaller the number is, the better visibility the overall option has.

3.Calculate standard deviation of students in each studio to analyze distribution equalty for each studio. The smaller the number is, the more averaged the distribution is.

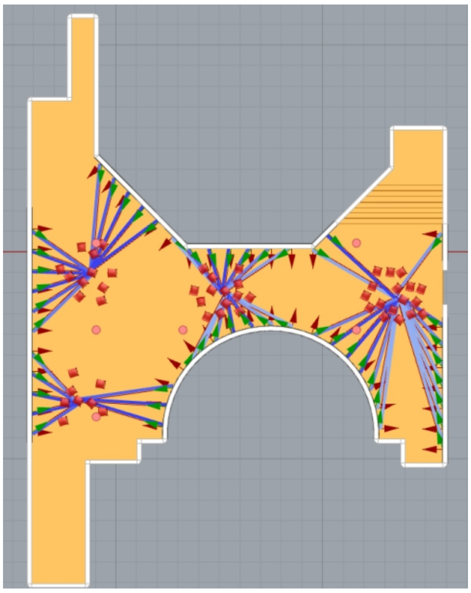


Figure13. metric1:view angle

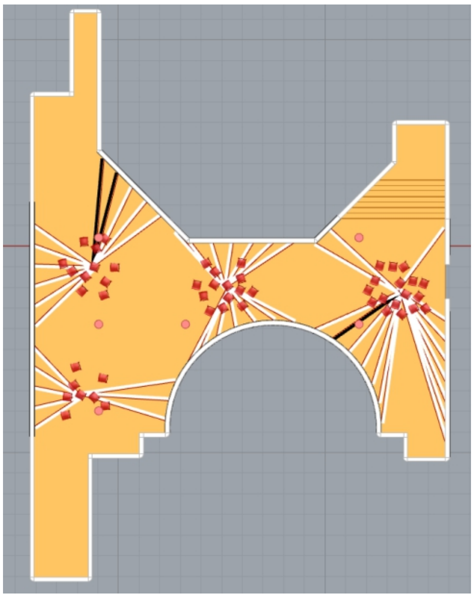


Figure14. metric2:visionbility

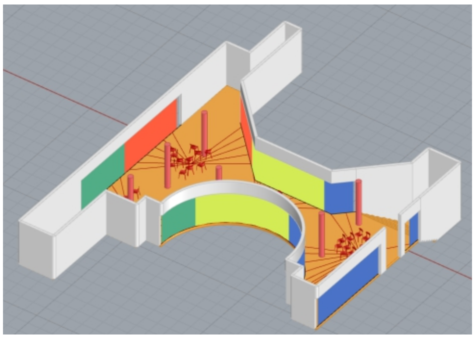


Figure15. metric3:standard deviation

Spatial Programming Language

Export file and upload to Scout

After developing the model in grasshopper, which includes input parameters, metrics for selection and analysis, and numerous design options, I proceeded to export this data along with the model into CSV files and several JSON files for uploading to Scout. Scout, provided by KPFui, is an interactive user interface platform. Users are responsible for uploading models and data onto this platform, which then generates an interactive interface. Through this interface, users can adjust various pre-set input parameters, review the metric properties of different options, and select the optimal solution according to their requirements.

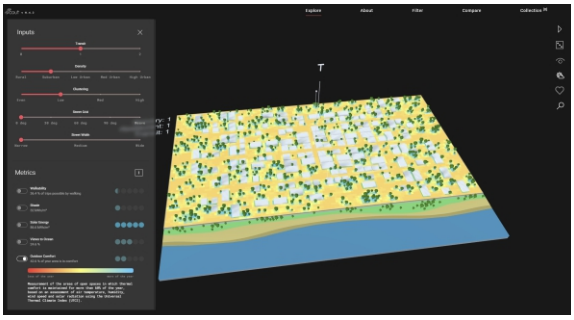


Figure16. An example from KPFui's Scout: Hawaii project

Scout Website

Instructions on using Scout

I have completed exporting all the files required for uploading to the Scout Dev website, including three JSON files and one CSV file, all of which have been compiled into a zipped folder. The files 'context.json', 'settings.json', and 'data.csv' are standalone and should be uploaded to their respective locations individually. However, for the 'models' section, the entire contents of the folder named 'models' need to be uploaded. Please note that due to limited space on Scout Dev, the initial upload might crash. There is no need for alarm in such a case; simply repeat the steps and re-upload.

Once all the files are successfully uploaded, click on 'start scout', and you will be pleasantly surprised to see an interactive web page generated. This interface is exceptionally clear and straightforward, allowing you to experiment with adjusting parameters and to view the metrics of various options. I have included a video that provides a detailed demonstration of what we can achieve with this interactive interface.

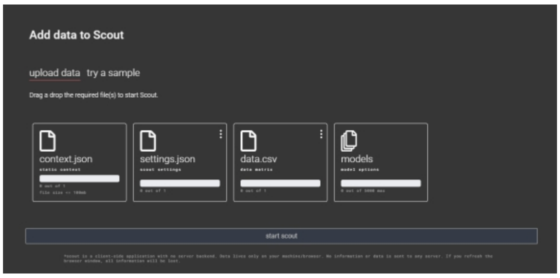


Figure17. files to upload on scout: context.json, settings.json, data.csv, models

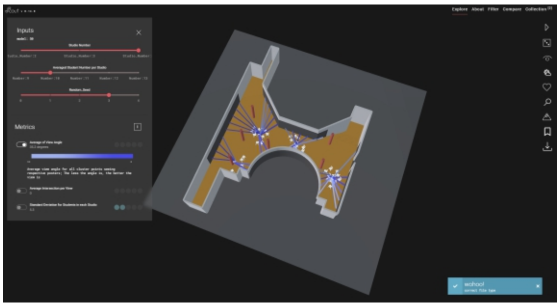


Figure17. files to upload on scout: context.json, settings.json, data.csv, models

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Upload files to Scout

Conclusion

In this innovative project for GSAPP's Avery basement, I developed a spatial programming language to optimize studio reviews within the constrained space. A SWOT analysis identified its potential as a multifunctional area, prompting the creation of a parametric model in Grasshopper. This model, considering factors like studio count, student numbers and random seed, generates diverse design options to efficiently utilize the space.

The model's data, including metrics and design choices, were exported into JSON and CSV files for integration with the Scout Dev platform. This integration results in an interactive web interface, allowing users to explore different spatial arrangements and select optimal solutions. The project demonstrates a novel approach to space management in architectural education, maximizing limited resources while fostering academic interaction and innovation.