532

The socio-spatial qualities of informal learning spaces

BEATRIX EMO, GREGOIRE FARQUET, MOMOYO KAIJIMA, & CHRISTOPH HOELSCHER

ZHAW, WINTERTHUR & ETH ZURICH, SWITZERLAND

ABSTRACT

The paper uses space syntax methods to compare the impact of possible redesign options on the quality of informal learning spaces in a university building. Informal learning spaces are defined following the learning sciences concept of formal versus informal learning; they cater for learning embedded in a mix of different activities, including talking, eating, socialising. Isovist and visibility graph analysis are used to evaluate the socio-spatial qualities of three design options of the hypothetical redesign of the case study: a multipurpose space for students that houses catering, sports facilities and the university shop. Findings highlight how important the likelihood of social interaction and the level of visual privacy are for defining the type of learning that is expected to happen in informal learning spaces.

KEYWORDS

Informal learning, learning spaces, university, space syntax, behaviour

1 INTRODUCTION

University students learn in a multitude of spaces. We examine one type of university learning space termed ‘informal learning space’, which are spaces in which students typically combine learning with other activities: the mix of activities is a defining factor. Informal learning spaces are defined in contrast to formal learning spaces (Emo et al., 2021). The distinction between formal and informal learning spaces draws on the distinction in the learning sciences literature between formal and informal learning (Bekerman, Burbules, and Silberman-Keller, 2006). The application of the learning sciences concept as a spatial concept has been applied to building typologies, such as museums/informal versus schools/formal (Callanan, Cervantes, & Loomis, 2011). For university buildings, we argue that formal learning spaces refer to those spaces that are primarily designed for learning. Examples of formal learning spaces are classrooms, seminar rooms, auditoriums, scientific laboratories and computer workstations. Another type of space are informal learning spaces, in which students pursue learning alongside activities such as eating, drinking and socialising. The design of such spaces has been neglected (Walton and Matthews, 2017), with more emphasis placed on the design of spaces for quiet individual learning (Boys, 2015), resulting in a lack of knowledge about the characteristics of such spaces and how they can be optimally designed.

This short paper discusses why the use of space syntax tools is relevant when considering what makes certain university informal learning spaces effective. This is done at the hand of a project that considers the consequences of possible redesign options on the quality of the learning spaces in a university learning and dining space.

1.1 Review

The use of space syntax methods to explore behavior in learning spaces is not new. While space syntax has been applied to the analysis of behaviour in universities, especially in connection with the urban campus (e.g. Soares et al., 2020; Da Silva et al., 2017; Capillé & Psarra, 2014) and individual university buildings such as libraries (e.g. Both et al., 2013; Aydoğan & Şalgamcioğlu, 2019), a large body of work has been done on the spatial configuration of schools. Several papers discuss the case of schools, both in terms of school classrooms (Sailer, 2018; Heitor & Pinto, 2012) and school buildings more generally (Fouad 2021; Fouad and Sailer, 2019). We focus on the single case study reported below, which relates to a series of spaces in a university building. The focus on university learning spaces comes from the collaborative research project on how the design of university informal learning spaces impacts the student experience[1].

2 CASE STUDY

The case study was the top floor of a multi-purpose building, close to the main building of a Swiss university. The building is something of a student hub given its central campus location and the many facilities it offers (catering, bar, university shop, sports facilities). The building is in need of refurbishment and so our project considered various hypothetical possible design solutions for the top floor only (Brunhart et al., 2021). The project brief was to offer a redesign of the space, retaining all of the existing facilities, whilst making it a vibrant space for learning. The focus of the project asked whether dining spaces can be effective learning spaces; in this paper, we will explore what effect the redesign options have on the quality of the learning spaces.

We conducted two types of visibility analysis from the space syntax toolkit of methods, isovist analysis and Visibility Graph Analysis (VGA), that can predict how people are expected to

[1] 'Future Learning Spaces' project, part of the Future Learning Initiative, ETH Zurich www.fls.ethz.ch

behave in a space. Space syntax is set of theories and methods that relate the configuration of a space to how it is used (Hillier and Hanson, 1984; Hillier 1996); for an introduction to space syntax at building scale see Bafna (2003). Isovists are 2D polygons taken from a specific generating location that show all the visible space from that location (Benedikt, 1979). Behavioural studies have linked isovist properties to behaviour (see for example Wiener et al., 2007). We computed isovist analysis for two standpoints (the left and top entrances). Visibility graph analysis computes the reciprocal intervisibility properties of all possible generating locations in a space (Turner et al., 2001) and has been widely used to explore predicted behaviour in a wide range of building typologies. Isovist and VGA was computed using the Isovist software[2], which allowed for transparent surfaces to be identified and so the analysis was performed for two conditions: accessible space and visible space. Accessible and visible space differ due to the ability of the software to identify transparent surfaces, so visible space includes spaces that can be seen but cannot be reached (due to, for example, a transparent wall). In the VGA, output graphics were black and white in order to fit with the nature of the other graphics produced for the project; spaces that have a high potential for social interaction are shown in black, whereas spaces that have low potential for social interaction are white.

Three floorplans were analysed: the status quo, and two variations. The floorplans shown in the below graphics will be briefly explained here in text form. The case study has several entrances coming from outside: one on the left, two on the right and two from the terrace below (that has seating). There is an additional internal entrance at the top of floorplan that connects to another building. There are two cafeterias in each floorplan that change shape and orientation in options 1 and 2. The university store, housed in the top area of the floorplan, gains in prominence in options 1 and 2 by moving from a peripheral unit in the status quo into the walking zone through the polygonal spatial units seen in the top of the floorplan in options 1 and 2. The floorplan shows closed off areas that are not accessible to students.

3 RESULTS

The spatial analysis sheds light on the difference in predicted behaviour in the three design options.

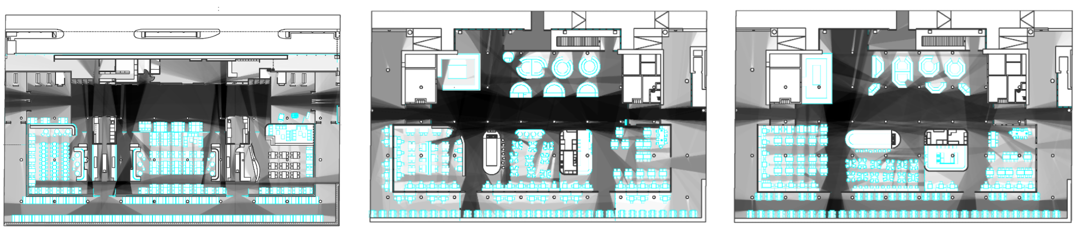

Figure 1. Accessibility for status quo (left), option 1 (middle) and option 2 (right).

[2] www.isovists.org

Figure 1 shows VGA Integration for accessible space and thus shows the predicted potential for social interaction in the space. The graphic reveals how the core of the space changes from a horizontal axis only to a combined horizontal and vertical axis in options 1 and 2. The strength of the vertical axis becomes even more prominent in option 2 compared to option 1 given the linearity of the space connecting the top entrance with the bottom left terrace entrance. The creation of a dual axis has an impact on the quality of the learning spaces, especially to the bottom left seating area, that is mitigated in option 1 through the partition separating the bottom left seating area to the connection space with the terrace. As a result, the learning spaces in the bottom left corner which are well-used learning spaces in the status quo, retain that quality in option 1, but become more socially-integrated in option 2. The predicted change in movement through the right-hand corridor between the three options also impacts the quality of the learning spaces in the bottom right corner of the floorplan, making them more integrated and thus more suitable to collaborative exchange as opposed to quiet individual learning.

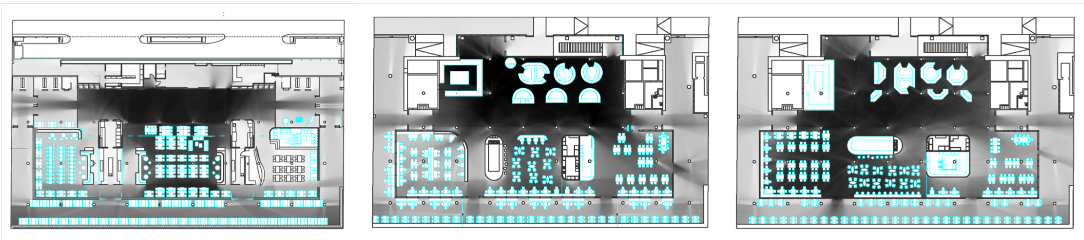

Figure 2. Visibility for status quo (left), option 1 (middle) and option 2 (right).

While figure 1 showed how likely the seated areas are to be spaces for social interaction, figure 2 shows how the visual connections between the seated areas and the rest of the space changes in the three floorplans. This is relevant when thinking about the level of privacy that students may want while they use such spaces for informal learning. As expected from the analysis in figure 1, the seated area in the bottom left of the floorplan retains much of the same quality in option 1 due to the partition wall, but is visually much more connected to the entire floorplan in option 2. This suggests that in option 2 this zone would be preferred by students who want to be visually connected to the rest of the space, lending itself to group work, and collaborative exchanges. This is in contrast to the use of the space in the status quo and in option 1, which would be preferred by students who do not want to be disturbed by others.

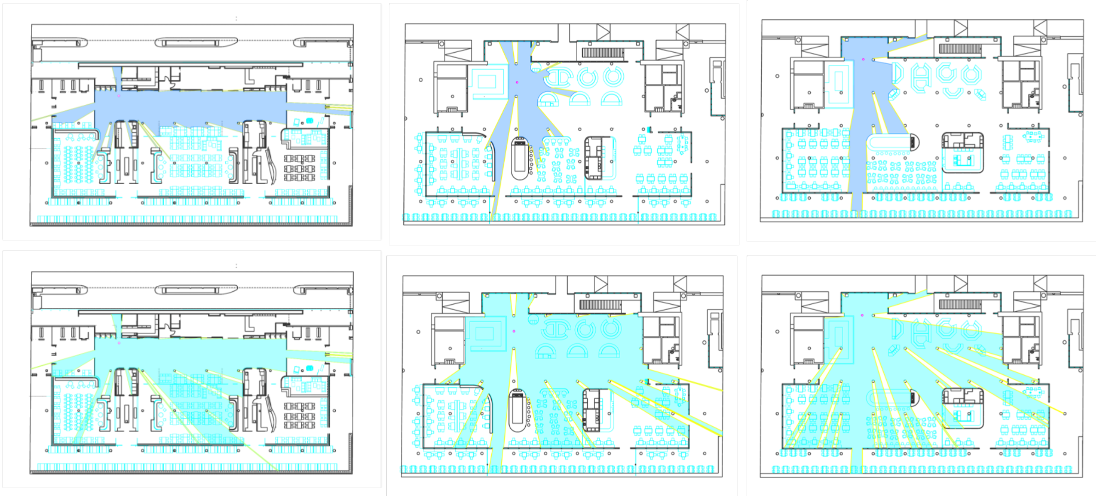

Figure 3. Example isovist analyses performed for the status quo (left), option 1 (middle) and option 2 (right) floorplans. The top row shows accessible isovists; the bottom row shows visible isovists. The generating location is shown in magenta.

We performed isovist analyses from two generating locations (left entrance, and top entrance) for accessible and visible space conditions; figure 3 shows those analyses for just the top entrance. The accessible isovists (top row) show the development of a prominent vertical axis in option 2, connecting the space immediately with the terrace. The implications of this are more prominent in the visibility isovists (bottom row), that shows how much greater the visual connections throughout the floorplan are in option 2 compared with the other floorplans. This impacts the quality of the learning spaces; spaces that are more connected with other spaces lend themselves to more collaborative learning and are more socially interactive. Overall, the findings from the isovist analysis were less powerful than the findings from the VGA, however the value of performing isovist analyses from specific locations is relevant for relating the design proposals to specific locations that can be chosen as generating locations. In our case study, for example, the stakeholders of specific facilities within the space (such as the catering and shop facilities) may be in interested in the isovist analysis to understand predicted behaviour to their facility.

4 CONCLUSIONS

A multitude of factors make university informal learning spaces effective. We argue that space syntax analysis is helpful in predicting how such spaces may be used. At the hand of a hypothetical redesign project of a real case study, we consider how socio-spatial methods can elucidate factors that may impact the quality of the learning space. The analysis showed that 1) the likelihood of social interaction and 2) the level of visual privacy are defining elements in prescribing whether an informal learning space lends itself to more individual or more collaborative learning. It should be noted that this type of analysis relates to expected behaviour, and we have not compared the simulated behaviour of the status quo floorplan with real observed behaviour in the space. Also, more work is need to gauge student's learning space preferences;

these may change depending on location and time. Socio-spatial tools such as isovist and visibility graph analysis may be helpful in understanding the spatial element of that finding.

REFERENCES

Aydoğan, H. & Şalgamcioğlu, M. E. (2019) Spatial preferences in university libraries of Istanbul: A Comparison on Syntax and Function of Space. In: Qiang et al. (Eds.) *Proceedings of the 12th International Space Syntax Symposium*, Beijing, China, July 2019, 281: 1-22.

Bafna, S. (2003). Space syntax: A brief introduction to its logic and analytical techniques. *Environment and Behavior*, 35(1), 17-29.

Bekerman, Z., Burbules, N. C., & Silberman-Keller, D. (Eds.). (2006). *Learning in places: The informal education reader* (Vol. 249). Peter Lang.

Benedict, M. (1979). To take hold of space: Isovists and isovist fields. *Environment and Planning B*: *Planning and Design*, 6, 47-65.

Both, K., Heitor, T. & Medeiros, V. (2013) Spaces for knowledge: strategies in academic library planning and design. In: Kim, Y. O., Park, H., T., Seo, K. W. *Proceedings of 9th International Space Syntax Symposium,* Seoul, Korea, November 2013, Sejong University Press 2013.

Boys, J. (2015) *Building better universities: strategies, spaces, technologies*. Routledge

Brunhart, O., Farquet, G., Rossbacher, L., Edinger, E.C. & Emo, B. (2021) 'Können Verpflegungsorte gute Lernplätze sein?'. Technical Report, Vol 1 (1), *ETH Zurich Chair of Cognitive Science and Chair of Architectural Behaviorology,* pp. 1-55.

Callanan, M., Cervantes, C., & Loomis, M. (2011). Informal learning. *WIREs Cognitive Science*, 2, 646–655.

Capillé, C. & Psarra, S. (2014) Space and Planned Informality: strong and weak programme categorisation in public learning environments. *A/Z ITU Journal of the Faculty of Architecture*, 11 (2) pp. 9-29.

Da Silva, L.C., Heitor, T.V., & Calvo-Sotelo, P.C. (2017) How exclusive do we want to be? Exploring the university realm in the contemporary urban territory. In: Heitor, T., Serra, M., Pinelo Silva, J., Bacharel, M. and Cannas da Silva, (Eds.) *Proceedings of the 11th International Space Syntax Symposium*, Lisbon, Portugal, 3–7 July 2017.

Emo, B., Farquet, G., Kaijima, M., & Hölscher, C. (2021) Linking the design of university learning spaces to students' experience. In: *Cognitive Processing*, 22 (Suppl 1): pp. 45

Fouad, A., & Sailer, K. (2019). The Design of School Buildings. Potentiality of Informal Learning Sapces for Self-Directed Learning. In: Qiang et al. (Eds.) *Proceedings of the 12th International Space Syntax Symposium*, Beijing, China, July 2019, 164:1-22.

Fouad, A. (2021) Implications of the Spatial Design of School Buildings on Student Interactions and Student Self-Directed Learning Activities. *Doctoral thesis*, University College London.

Heitor, T., & Pinto, R. M. (2012). Thinking critically towards excellence in school buildings using space syntax as a catalyst for change. In: Greene, M., Reyes, J. & Castro, A. (Eds.) *Proceedings of the 8th International Space Syntax Symposium* (8018: 1-18), Santiago de Chile, Chile, January 2012.

Hillier, B. (1996) *Space is the machine.* Cambridge University Press.

Hillier, B. & Hanson, J. (1984) *The social logic of space*. Cambridge University Press.

Sailer, K. (2018) Corridors, classrooms, classification – The impact of school layout on pedagogy and social behaviours. In: Tse, H. M., Daniels, H., Stables, A. & Cox, S. (Eds.) *Designing Buildings for the Future of Schooling: Contemporary Visions for Education*. (pp. 87-112). Routledge: Abingdon, Oxon.

Soares, I., Weitkamp, G., & Yamu, C. (2020) Public Spaces as Knowledgescapes: Understanding the Relationship between the Built Environment and Creative Encounters at Dutch University Campuses and Science Parks. *Int. J. Environ. Res. Public Health*, 17, 7421.

Turner, A., Doxa, M., O'sullivan, D., & Penn, A. (2001). From isovists to visibility graphs: a methodology for the analysis of architectural space. *Environment and Planning B: Planning and design*, 28(1), 103-121.

Walton, G., & Matthews, G. Evaluation of informal learning spaces. In: Walton, G., & Matthews, G. (Eds.). (2017). *Exploring informal learning space in the university: A collaborative approach*. Routledge, pp. 145 – 159.

Wiener, J. M., Franz, G., Rossmanith, N., Reichelt, A., Mallot, H. A., & Bülthoff, H. H. (2007). Isovist analysis captures properties of space relevant for locomotion and experience. *Perception*, 36(7), 1066-1083.