

Exploring Opportunities for Community Building in Atlas – the World’s Most Sustainable Education Building*

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Abstract

This paper explores the following research question: How to make the most of an academic community through norms, culture and practices within the academic environment? Fifteen semi-structured interviews with stakeholders of the Department of Industrial Design (ID) from Eindhoven University of Technology (TU/e) have been conducted in a case study that aims to understand the approach knowledge workers have when navigating the university knowledge space to maximize benefits of their local community. Thematic analysis has been performed and ten themes describing norms, culture and practices within the environment emerged. The findings indicate that the conditions needed to facilitate community building in the university are contextual planning, on-time rich information and serendipitous interaction. The paper expands the literature on university knowledge spaces by placing emphasis on community building and participatory communication in the context of smart city infrastructure.

Keywords: community building, academic community, knowledge space, knowledge worker, learning space, corporate real estate management, smart city infrastructure.

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1. Introduction

Universities have expanded their role from educational centres of cities to focal points of the knowledge economy due to their increased connection to industry and private sectors [1]. However, many university campuses function in old-fashioned facilities that are unable to keep up with these fast societal changes; the vast majority of university buildings in Europe are in a bad technical and functional state and date from the 1960s-1970s [2]. This situation creates many opportunities to develop better facilities into spaces that accommodate today’s knowledge workers - students, staff and visitors [2, p. 167], as they make increasing use of new information and communication technologies (ICTs) and hold shared spaces in high demand [3].

The expectations of students regarding learning spaces have changed over the last decades: they require spaces that support both individual and collaborative activities, encourage informality and flexibility and put “a strong emphasis on social learning and advanced technology” [4, p. 140]. Social learning is an important asset of university knowledge spaces because students develop creative thinking in social environments that foster learning through social interaction with peers and active guidance from teachers [5].

The knowledge economy requires professionals who have been trained in teamwork, cooperation and who care about others; for this, students nowadays must engage in self-assessing their own performance and be open to criticism, practice self-directed learning and reflective thinking. Moreover, they must continuously adapt their learning style to engage in new practices that foster creativity and use new technologies for learning [6]. Similarly, the large adoption of

* According to the Building Research Establishment Environmental Assessment Method [27]

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ICTs has brought changes in the way people live and work; nowadays, workspaces must adapt to both remote and flexible work and offer possibilities to have fun, spark their employees' creativity and make them feel at ease to express their feelings: "Earlier the office used to be a place to work; now the office seems to have a more demanding role, as a place where people practically live, as well as work" [7, p. 333].

Despite the large adoption of ICT services by knowledge workers, universities require now (more than ever) the physical presence of both students and staff: while knowledge exchange can happen virtually, face to face communication and social interaction are vital to knowledge creation and innovative thinking [8]. By working together, learning from one another and engaging in creative and social activities within a shared place, university knowledge workers contribute to a knowledge space that is attractive, flexible, versatile and fosters trust, community and awareness [9].

Communities provide a structural role for knowledge work by offering people direct access to knowledge and innovation and providing belongingness, influence, integration and emotional connections [10]. In this context where knowledge is being generated and exchanged daily by means of direct interactions between students, staff and visitors likewise, modern university knowledge spaces should encourage community - related activities and behaviour to enhance knowledge work.

According to Tuulos [11] we can analyse how modern knowledge work is influenced by the design of the environment where it takes place if we consider its three components: physical space, mental space and social space.

The physical space is represented by the designed construction and physical elements users recurrently interact with. As a result, they attach mental cues, rules and norms of behaviour which represent the intersection between their mental space with the physical one.

A person's mental space represents the user's behaviour and state of mind which affect how they interact with the community and contribute to their ways of working, generating organizational culture and practices within that community.

The social space in modern knowledge work is represented by the social interactions and community building activities that take place in the physical space, creating the environment of knowledge work. An overview of how the physical, mental and social space contribute to a knowledge space through a set of additional subcomponents – norms, culture and practices and environment is presented in Figure 1, as featured by Tuulos [11].

1.1 Norms

The way people behave is impacted by the space where they engage in that behaviour. Those with whom we use to share a space influence how we behave more than the people who are not as physically close, thus spatial proximity is an important factor in constructing social norms [12]. When we feel insecure of how to act in a certain space, we mimic other

people's behaviour to fulfil our need to assimilate, to feel part of a group [13].

A space that supports, guides and promotes positive behaviour will more likely contribute to activities beneficial for knowledge work. Lastly, normative behaviour depends on a design that affords clear understanding of what is permitted and what is out of place [11]. When we are not familiar to what is expected of us in a certain place, we become disoriented and our whole experience in that environment suffers.

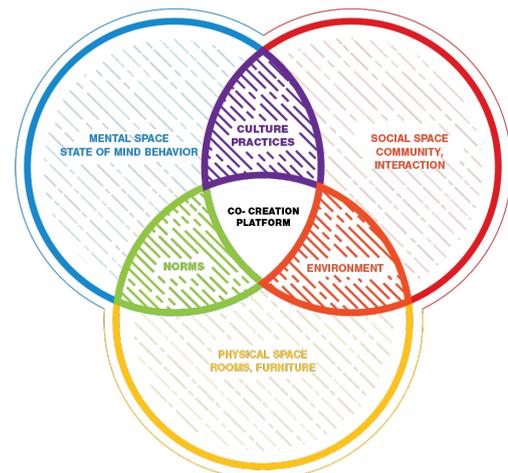


Figure 1. The components and subcomponents of an academic co-creation space, as presented by Tuulos [11, p. 125]

1.2 Culture and practices

In the context of modern knowledge work, organizational culture determines work performance because the cultural context is connected to all aspects of work – knowledge creation, knowledge sharing and knowledge implementation [14]. Bierly, Kessler and Christensen [15] define organizational wisdom as an important construct determining knowledge transfer and explain the importance of organizational culture in creating a wise organization: “the promotion of specific values that are in line with the strategic focus of one’s organization, for example creativity, quality or social responsibility, can significantly aid in the wise selection and translation of plans and objectives for organizational members” [15, p. 611]. In universities nowadays, knowledge creation and transfer have shifted from formal activities and rigid classroom environments towards informality and social interaction, direct experiences and real-life situations.

The culture and practices that support a broader understanding of knowledge work which includes informal settings and community-oriented activities can increase people’s motivation to use a knowledge space [16].

1.3 Environment

Knowledge work calls for balance between social interactions and individual work time. To avoid cognitive overload caused

by stress, increased workload and multitasking, workspaces should be designed to purposefully create conditions for awareness, collaboration and brief interaction without compromising personal space, concentration and privacy [17]. For students, the physical learning environment influences the learning process and they feel this influence later in life, even after the learning space is no longer part of their daily activities [18]. For nowadays learning spaces it is a substantial design challenge to provide an interactive learning experience comprised of place-bound knowledge creation through group engagement and enhanced, technology-mediated learning activities [19]. The integration of ICT as an additional digital layer in learning spaces brings new affordances to this experience, as it encourages reflection, knowledge sharing, collaboration and flexibility [20].

The approach we take when we design a modern university knowledge space should take into consideration the type of behaviour it supports among users, the culture that it instils and the affordances for diverse knowledge related activities. This paper investigates the role of these three dimensions in creating enjoyable and easy-to-use spaces that respond to the complex needs of today’s knowledge workers in academia.

The importance of this study lays in the paradox that most of nowadays ground-breaking work is conducted in outdated facilities that do not correspond to the needs of our modern society. This paper adds to the body of research concerning higher education spaces in relation to modern tendencies in knowledge work and brings a fresh perspective by deconstructing user experiences and expert insights into behavioural, social and environmental implications.

The aim of this research is to explore the complexity of knowledge spaces in relation to modern day technological advancements and the consequences they have on academic knowledge work, by putting an emphasis on the people behind it. The study analyses the following research question:

- *How to make the most of an academic community through norms, culture and practices within the academic environment?*

The question is answered by investigating user experiences from a state-of-the art university knowledge space and combining them with expert insights involved in the process of accommodating the users from initial design to post-occupancy evaluation. The study uses a qualitative approach and analyses its findings by mapping them onto the framework proposed by Tuulos [11], as shown in Figure 1; in addition, we add digital space as an additional layer of the physical space component of this framework to reflect the latest trends in modern knowledge work where physical objects are often merged with digital technology. Figure 2 presents the updated framework featuring the digital dimension of the space.

In the next part of the paper we analyse a series of related studies which explore the balance between work-related tasks and community activities in different types of knowledge spaces. The setup of our study which analyses the academic knowledge space of the Department of Industrial Design (ID)

of Eindhoven University of Technology (TU/e) is presented in the case study section together with the research methodology. Next, our findings comprised of ten context-rich themes are thoroughly presented and are followed by a discussion where design recommendations for community building are proposed. Finally, the paper concludes with a synthesis of the qualities necessary for an academic knowledge space to maximize benefits among users.

Within the scope of this research we explore how the combination of state-of-the-art ICTs and building infrastructure of the smart city can enable human capital and bring positive social change among users through purposeful design. Therefore, we contribute to the theme of this journal by highlighting the implications of design decisions for creating liveable, inclusive and socially relevant spaces in the context of nowadays knowledge work.

The study provides useful suggestions on supporting community building for corporate real estate management experts, as well as interaction designers, architects and planners. The study expands the literature on academic knowledge spaces by placing emphasis on community building in the contexts of HCI and smart city infrastructure.

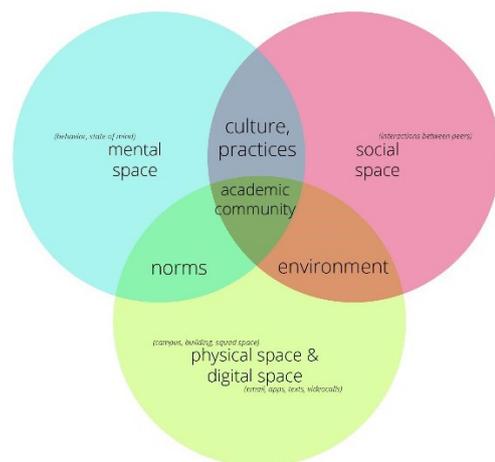


Figure 2. Norms, culture & practices and environment that build an academic community space

2. Related works

As nowadays academic knowledge workers are becoming increasingly engaged in informal activities, social interaction and collaboration, university knowledge spaces have started to combine various features of collaborative work environments. We propose a series of related works that analyse user experiences in several types of workspaces focused on collaboration and fostering workplace community: coworking spaces, co-creation platforms, state-of-the-art office environments and collaborative makerspaces.

Tuulos [11] describes the environmental qualities that support knowledge work based on the impact they have on the knowledge community members. It presents the Aalto Design Factory, a state-of-the-art university building

designed for teaching, learning, research and industry cooperation, where social interaction and community building play an essential role in supporting experiential learning as pivotal part of knowledge work. The study utilizes a conceptual framework of analysis inspired by Henri Lefebvre's triad of space which distinguishes between the local culture, attached norms and environment as key components of our surrounding space.

On a similar note, Nenonen analyses the balance between the "physical, social and virtual layers of spaces for knowledge creation" [21, p.237] necessary in nowadays knowledge work environments. The study shows that there are several types of spaces needed in different stages of knowledge work and that they typically enable explicit knowledge sharing but fail to support tacit knowledge exchange. Such qualities can be easily met when the designed spaces carry some of the features accommodated by coworking spaces: networking with people from a variety of backgrounds, collaboration and individual work.

Bilandzic and Foth [22] conduct an ethnographic research at The Edge – a library space dedicated to coworking, social learning and collaboration through digital technologies to understand user behaviour and motivations. Their study presents five personas that support and inform design strategies for spaces which foster shared learning and collaboration across physical and digital environments.

Likewise, Sankari, Peltokorpi and Nenonen [9] investigate user experiences in higher education learning spaces to understand whether these could benefit from co-working principles. The results suggest that characteristics typically found in coworking spaces are positively experienced by users of academic spaces. These are community, multipurpose office design, high accessibility and workplace attractiveness.

Windlinger, Nenonen and Airo [23] combine a qualitative interview study of an office relocation project in Finland with a quantitative survey study of 43 office buildings in Switzerland to explore workplace usability. They differentiate between usefulness and user-friendliness to provide a more accurate representation of office workers user experience. The findings show that this combination can be beneficial for the field of office management as usefulness refers to "workplace provisioning and workplace concepts as designed entities" while user-friendliness speaks about "user behaviour and the perception of comfort" [23, p. 660] both being valuable aspects to consider when designing usable office spaces.

Lastly, Capdevila [24] analyzes 43 collaborative spaces from Barcelona and Paris in a qualitative study that explores user motivations to access such spaces. It provides a useful classification of different types of collaborative spaces where innovation, activity diversification, entrepreneurship, user participation and engagement are the main drives for maintaining user interest and commitment over time.

These examples are only a few from an expanding domain of research into the qualities and design decisions behind collaborative spaces that support social interaction in modern knowledge work. They represent an increasingly popular

tendency to bring forward spaces that are socially relevant, inclusive and connected to user needs for community.

Our paper adds to this body of research by investigating user experiences in a state-of-the-art facility for academic knowledge work through a qualitative study which provides deep insights into user behaviour, habits and perceptions of such a space.

3. CASE STUDY: the TU/e Department of Industrial Design move to Atlas - a unique opportunity to explore academic community building

3.1 Research setting

To achieve the goal of this research, we have taken advantage of a very rare opportunity to witness the first few months when an entire academic department moves its headquarters to a recently renovated facility. This building has been awarded the "world's most sustainable university building" by the Building Research Establishment Environmental Assessment Method (BREEAM) [25]. We believe that this university unique setting combined with the timing of this study create the premises for a fresh perspective on community building for academic knowledge workers.

The department of Industrial Design (ID) from Eindhoven University of Technology (TU/e) has functioned since the inauguration at the beginning of the 2000s in the TU/e Main Building. This construction is comprised of 12 3400 sqm stories, out of which the ID department has occupied 3 (and at times, 4). The building has been designed by the Dutch architect Van Embden in a modernist style in the 1950s and was completed in the 1960s.

At the moment of the TU/e Industrial Design inauguration, the building had already undergone a few renovation stages, but a major one only happened between 2013-2019. During this time, the department had been temporarily downgraded to a 2-storey office building (Laplace) originating from the 1970s. Laplace featured an open plan where all student spaces, laboratories and researchers' offices have been organized around a central common area for both students and staff to share. Although the allocated space was considerably smaller than the one in the Main Building, community thrived here around the central community space.

At the beginning of 2019, ID has moved back to the Main Building (now named Atlas) which has undergone a complete renovation which only kept the initial concrete structure and the secondary circulation steel staircases from the old building. Here, ID shares facilities with another department – Industrial Engineering & Innovation Sciences (IE & IS) and the university corporate facilities, following a scheme of vertical zoning. The two educational departments occupy together most of the building floor area - from floor 2 to 9 and are located at the two extremities of the building floor plan, as shown in Figure 3. The yellow area represents the ID space, the blue area - the IE & IS space and the red area in the middle represents a transition space with classrooms,

informal work areas and meeting rooms used by both departments. As an additional feature, the red area is designed to afford flexibility and future reconfigurations within the two departments which can expand or contract according to the number of students and researchers they house.

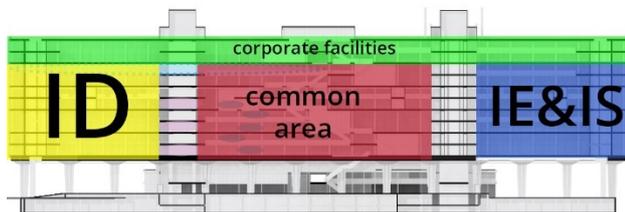


Figure 3. A vertical section through the Atlas building showing the main department areas

The newly renovated building (Atlas) represents the state-of-the-art in sustainable university buildings as well as in community engagement policies [26] and has been awarded the BREEAM [27] award for the most sustainable education building. The renovation process of Atlas is part of the TU/e campus strategic development masterplan (2010-2020) that proposes the transformation of a formerly closed and monofunctional campus into a broad ecosystem where education and research activities blend with business, cultural, recreational and residential activities [26].

Following these principles, this building is considered a steppingstone into “The New Way of Working” (as translated from Dutch by the authors), a strategy developed by the university to encourage multidisciplinary interactions, cohesion and collaboration amongst students and staff [26].

Moreover, the building has been designed following principles of coworking [28]. The ambitions regarding building users – students, scientists and staff members for the academic space include cooperation, knowledge development and sharing and dynamism: “The working environment is closely interwoven with the educational environment. Meandering through the educational landscape, scientists are in contact with students and science” [28, p. 9].

3.2 Method

Data collection

The study builds on two main datasets emerging from user perspectives and experiences of the Atlas building and expert opinions and strategies for community building within Atlas and the Department of Industrial Design. The first dataset stems from a diversity of data sources, comprising of 9 semi-structured interviews and 15 qualitative questionnaires, participant observation of daily activities of different community members and a user generated map with preferred places for informal encounters.

The questionnaires have been initially deployed to gain a rapid understanding of the workplace dynamic and to explore which questions trigger more in-depth responses. The survey contained 12 open questions about informal meeting preferences, meeting approach techniques, habits or cues employed by users. Moreover, the questions asked about

preferred types of information regarding other users, their availability and meeting preferences such as preferred time of the day, location and topic predilection. The survey has been deployed among Bachelor, Master, PhD students and academic staff and after 15 responses we got enough information about the topics which require to be discussed more in depth.

Together with the daily observation and the user generated map, the survey pointed out that formal meeting habits must be taken into account as well because they contribute to the way users structure and access the informal interactions to fit in between work-related meetings. Taking these into consideration, the semi-structured interviews have been designed around the following themes:

- user interpretation of general rules for using the different locations and facilities of the department in relation to formal and informal meetings with other TU/e Industrial Design members;
- user interpretation of common practices and TU/e Industrial Design organizational culture that contribute to the way members structure their schedule to fit community-related and work-related activities;
- user experience and views on affordances of the physical and social environment for informal interactions and an enjoyable work atmosphere.

Given that the main researcher is a master student of the Department of Industrial Design, the study has been continuously adapted to community life and data collection has been enriched with daily observation of culture and practices as well as community main events over a span of five months. The observations have been performed by the main researcher with the objective of understanding patterns, habits and behaviour in the different areas of the knowledge space and the recording method has been note-taking using a personal smartphone with a mobile application for notes.

This comes with a study limitation as well because, although efforts have been made to avoid it, it builds the grounds for researcher bias. As bias cannot be entirely avoided when the person conducting the study is a user of the knowledge space as well, we trust that sufficient use of theory can help overcome this potential setback.

The second dataset consists of 6 semi-structured interviews with experts on the TU/e Industrial Design academic community as well as the Atlas design, renovation and moving process. First, to understand the discourse around the ambitions for the Atlas building and implicitly for the TU/e Department of Industrial Design, we interview three employees of the TU/e Housing Department: one communications adviser, the project manager of Innovation @Work, an initiative to introduce flexible working to the supporting staff working in the building (located in the upper floors) and the project manager of the recent Atlas renovation.

Next, we interview the director of education for the Department of Industrial Design and a LUCID board member – the Industrial Design student association to get in depth knowledge about the strategies employed to encourage community building and social networking within the

department and between the design department and other design communities.

Sampling

In order to conduct expert interviews regarding the initial ambitions and ongoing strategies, we used the purposeful sampling technique. We identified people within the university who have experience with the Atlas renovation and moving process, then we continued with those who work on establishing a working environment based on principles of coworking [29] and we ended with those who actively work on strengthening the Industrial Design community. We believe that after these meetings we have reached saturation on this part of the study.

In order to explore how community members use and access the academic community, we approached members in different positions within this network: Bachelor (BS##) and Master students (MS##), PhD candidates (PC##) and researchers (AP##). We used purposeful sampling for the first iteration which consists of a qualitative questionnaire followed by a second iteration with interviews which are a more in-depth version of the first. In the third iteration we look at finding people within the network who are recommended by others as paradigmatic (positive) cases [30] for the way they access and use the community network.

Because the department has a relatively small community, there were only 3 cases pointed out by other members and due to availability issues and the time limited nature of this student-led research, we interviewed 2 of them. Regarding the user generated map with informal meeting spots, a poster containing an annotated floorplan has been placed on each of the 6 floors of the department shared by all categories of users. Participants have placed stickers on the desired area over the span of two weeks.

Data analysis

The data have been analysed qualitatively following a thematic analysis approach with guidelines provided by Braun and Clarke [31]. The approach explores shared topics and recurring ideas from participant stories as well as critical incidents or paradigmatic cases. The goal has not been to create a generalized image assumption built on everyday life moments, perceptions or community practices, but to paint a variegated picture of a specific academic context from which one can draw their own conclusion and build upon in further studies.

The community member generated data from the open-ended questionnaire and following semi-structured interview have been used for identifying, analysing and reporting patterns that can be used to describe the reality of the TU/e Industrial Design academic community in rich detail.

User reactions, stories, examples and remarks have been clustered in ten themes that describe the norms and practices within the academic environment which derive from the way a member utilizes the mental, social, physical and digital spaces in relation to their community.

The user generated map has been used to clarify and shape a context for the analysis of the interviews and questionnaires.

The expert discussions have represented a contrast agent in the classification process.

We have operationalized the findings following the spatial triad theorized by the French philosopher Henri Lefebvre and interpreted in a contemporary approach by Tuulos [11] which describes space as the combination of three components: social space, mental space and physical space. To the latter, we have added the digital space dimension to better describe modern knowledge spaces in the context of flexible working and the use of ICT in many knowledge-work related tasks, as shown in Figure 2.

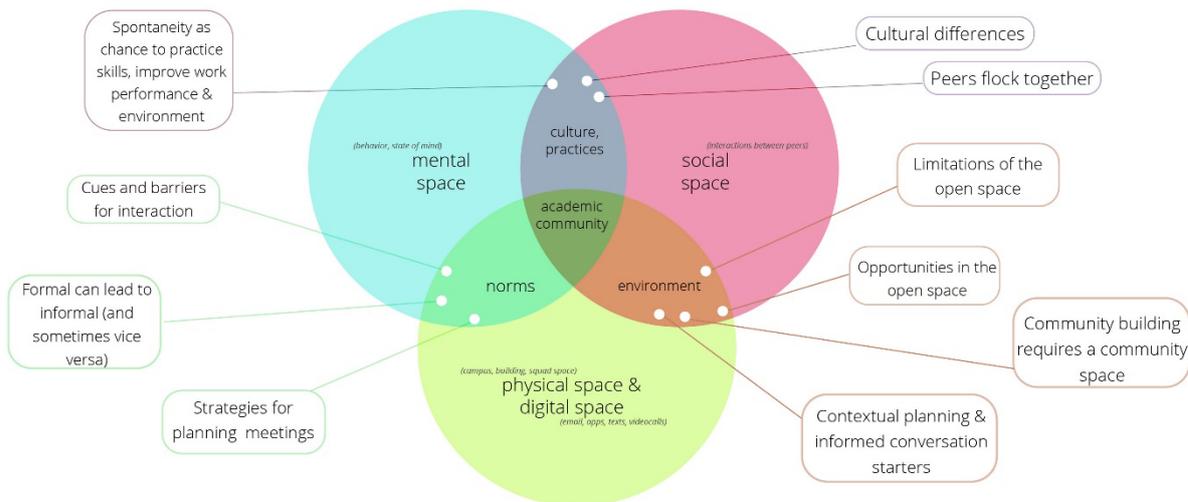
Because the qualitative survey and the interview represent two iterations of the same data collection method, we have analysed their results collectively, as part of one user generated dataset. We have manually transcribed the previously recorded interviews and hand-written survey answers in an Excel spreadsheet where each participant has received a unique code. The spreadsheet has been printed and the coding process has been done using analogue tools such as pen, paper, Post-it notes following the method of Braun and Clarke [31].

Ten themes emerged and are synthesized in a framework which can be further developed for other case studies and used to inform interaction design professionals and architects interested in HCI, applications of ICTs in smart city infrastructure and participatory approaches to city making, community and facility managers likewise. A limitation of this study could be considered the analysis process done by one researcher due to time-constraints. However, we must take into account that the thematic analysis method used [31] specifically targets such cases through an exhaustive approach on all coding stages that builds on top of rich, accurate descriptions to generate the final themes.

4. Findings

Table 1. 10 themes that describe the three components of the academic community

Theme No.	Spatial component	Theme Name
1	Norms	Cues and barriers for interaction
2	Norms	Formal can lead to informal (and sometimes vice versa)
3	Norms	Strategies for planning formal meetings
4	Culture & practices	Spontaneity as chance to practice skills, improve work performance & environment
5	Culture & practices	Cultural differences
6	Culture & practices	Peers flock together
7	Environment	Limitations of the open space



8	Environment	Opportunities in the open space	10	Environment	Contextual planning & informed conversation starters
9	Environment	Community building requires a community space			

Figure 4. Themes clustered following the three spatial components

A total of 10 themes emerged from the thematic analysis, grouped around the three components that describe the academic community space: norms, culture, practices and environment, as previously shown in Figure 2. An overview of the themes is presented in Table 1, ordered by spatial component. Each theme is individually explained in detail in the following section.

Figure 4 presents how the themes cluster following the three spatial components of the academic space: norms, culture & practices and environment.

4.1 Cues and barriers for interaction

Members of the TU/e Industrial Design community proceed differently when they must approach other members: they “just sort of lean over and then...”, or they have indirect approaches such as “usually, I just send them an email”. They believe “sometimes context is important” and they prepare the meeting in advance:

“I need to make an appointment instead of just going to the office” – MS#2

Some rely on own assumptions about others’ availability - “if the person is wearing headphones that is my cue to not disturb them”. Some quickly assess the situation as they “look at how they are working: are they talking with other people or are they really into their laptop”.

One member who is seen by others as a socially – connected individual (according to recommendations during interviews) has a high level of self-awareness as well as awareness of others and they make a constant effort to be perceived as an approachable person:

“I actually look at them or try to remember what they do. So that goes for students it also goes from my

colleagues. [...] I think I’m quite approachable. I don’t have like a wall. Or I don’t radiate any form of danger, I guess. Or intimidation. Which is good you know because it makes you quite approachable. [...] I am very aware. [...] I’m super alert.”- AP#2.

Another person recounts that they look for generally accepted cues in the workplace culture that hint them towards other members’ availability for chat:

“Usually they are available, I think the universal sign for being at work is having headphones on or earbuds in.”- MS#6

A member discloses that they rely on their personal interpretation of others’ behaviour, activity and state of mind before approaching someone else for a discussion:

“When people want to chat, they look happy, they are eating, drinking, and not behind their computer, but elsewhere.”- MS#5.

Location is considered an important factor in informal meetings, but also a deterrent depending on the activity that is linked to the location or the people who can be found there:

“I feel like location is so specific. If I run into someone in the city, we are on neutral ground now so I am allowed to have dinner here and so are you and that wouldn’t make me feel awkward, but I am not going to go to a space that I feel is for the students and I feel they maybe feel the same way about walking over here because they feel it is for...”- PC#1

Similarly, elements of the physical environment such as doors, walls and furniture are being seen as barriers against other people who might interrupt one conducting focused work. People from neighbouring desks are perceived as a deterrent against interruptions as well:

“I am just in my office if I do my own stuff. I think for many people is already quite the threshold to step into the

room. And then there's other people in the room too. So, I think there are plenty of barriers"- AP#2.

The lack of information about other members of the community can make people feel insecure and embarrassed to the point that they lose the initiative to approach others, one student explains: *"Honestly, I don't know if I would initiate conversation. I also don't know a lot of the staff; most people I have seen but I don't know what squad they are in or projects they have so I feel kind of a bit of embarrassment of not knowing that, it would hold me back"-MS#1.*

Furthermore, the absence of knowledge about others' location and their availability on the spot can make these users reluctant to approach people for impromptu meetings:

"Often, I feel like even if I knew where someone's desk is, I always feel like I don't want to walk up and interrupt them. So, if in some ways I would know that this is an ok moment to approach, that would help a lot more and would happen more spontaneously."-MS#1.

Lastly, one member reflects on their own experience of being interrupted from important work, which makes them doubt the legitimacy of their own actions:

"It happened yesterday when I felt like talking to some people but then having these disturbance problems myself I asked myself <should I do that?> Because they might be working on something very important, so it is give and take."- AP#1

4.2 Formal can lead to informal (and sometimes vice versa)

In relation to the way they access the TU/e Industrial Design community daily, members share that sometimes "you don't know how to approach someone if you don't have a specific reason", or "honestly I don't know if I would initiate conversation". The opposite is equally true: "I think I met most of my teachers informally during breaks from the class".

Their general opinion about the current social dynamic is that "there should be more interaction" while the recent Atlas move created a situation where "I don't talk to a selection of most of my colleagues anymore, let alone my students".

When they access their community, members need to establish formal ties before exploring informality. For staff members, this comes as a result of the organizational structure in the research groups which is enforced by everyday practices and embedded culture:

"[about the people from another research group] – I know them less because we are not in the same labs, we don't teach the same squads, so I have a little bit of less formal interactions with them." (PC#1)

Students, on the other hand, explore informality gradually as they expand their social circle and do not necessarily consider the organizational structure, but the personal level of comfort around a particular person:

"There would still be a difference between meeting a staff member I don't know and meeting the squad teachers because I feel more comfortable around them, I know what kind of relationship some people have [...] Some people are informal, some are strictly business and it's a bit hard to estimate how far you can go while with the students you can always be more casual." -MS#1.

Informality stems from a strategy implemented by the TU/e Industrial Design community organization which aligns with the formal organizational structure of the department and is expressed by the floorplan layout distribution. According to the Industrial Design education director, the most interesting serendipitous encounters take place in the faculty's labs and squad spaces as well as around the professors' offices or desks because by design, these spaces attract people with similar projects, activities, interests. Students consider that the opposite is similarly valid, because the squad spaces are determined first structurally by the people who are reunited by similar interests and then spatially by the area they occupy on a floor.

"You kind of know what these people are doing, for example that's WHY I'm in the X squad space because the people that work here are in the same topic or the same interest I am in." (MS#4)

4.3 Strategies for planning formal meetings

Members plan their formal meetings using a variety of methods to accommodate different meeting habits, schedules and personal preferences. Some prefer finding their meeting partner somewhere in the building and talk to them in person or schedule in person a following meeting if necessary:

"I just walk there and ask them a question; if they are busy, I ask when I can come back but that never happens."- BS#3

They rely on their social and spatial awareness to remember the details of every encounter:

"I think I might come across as someone who does these things effortlessly, but I am very aware of everything I do at my job."- AP#2

Some have a prolonged experience with the social culture and practices in the department:

"I never send an email, I just go there; I think it is about studying here for 3 years already and I gained experience with this; my teacher coach never responded so I had to go and bother her." – BS#2

Others prefer more indirect approaches and utilize a variety of digital tools to launch and mediate both planned and quick, dynamic consultations. They use the TU/e Outlook email service ("Usually, I just send them an email and ask about it. With C., my coach I send an email and then we schedule meetings on Friday in general"-MS#1), Slack [32] ("I like to work with digital tools - Slack, email is fine for many purposes especially when it comes to quick decisions."AP#1), Teams [33] ("With people that I don't know, I would probably send an email before. I'd do the same with my colleagues. We use Teams so when we meet

on Friday, I just leave a message if I want to talk for a bit”- MS#1), WeChat [34] (“We have this WeChat group with all the Chinese colleagues and ask who is for lunch and someone would always come.”- MS#2), and the TU/e intranet service (“For the info about their expertise and stuff, I usually just check the website”-BS#3).

There is a category of members who adjust their meeting approaches to the person they meet with or the type of meeting. They prefer combining a direct approach with the use of online direct messaging apps or email:

“for my supervisor, I take these stairs right here, if I need a walk, I take the other route and then I go and find her. If she is not by her desk, I will text her or WhatsApp her.” – PC#1

4.4 Spontaneity as a chance to practice skills, improve work performance and environment

When asked about the value they place on the time spent with other community members in brief, informal meetings, participants considered these “meaningful”, “like networking”, “very good”, “mutually benefitting”. Students especially appreciate the opportunity to rehearse their “relationship building skills” or just to discuss new collaborations because informality can “lead to something else than just casual talk”. Other students even notice that being part of a community can bring benefits over time because “a lot of people really helped me just from these small talks”.

By having social interactions with other academic community members, the participants have experienced an increased social awareness and a better collaboration dynamic:

“If I know the person better, I have a sense of how they might perform both professionally and in their personal life; they also get to know me. If you click, it is easier to get to work with someone. It can lead to something else than just casual talk.” - MS#3

Moreover, students appreciate the value that quick, unplanned meetings could have for testing their raw skills with the people who can provide expertise, council and guide them on their self-discovery journey.

“I think it would be really valuable (to have informal meetings) , it could help with relationship building skills but also in the department, because I don’t know everyone’s expertise [...] and probably there are many more coaches than just the people from my squad who can give some good insight on my project or who I could talk to about my vision, my development or some questions I’m asking myself.” - MS#1

For staff members on the other hand, time is a constraint which in many cases prevents them from accessing the community as much as they would because “usually, I don’t have time for that”, and “our time is super fragmented”. When they do find a window in their schedule to interact, it is “mostly with my colleagues that I sit with” and they “usually go to lunch together”. Here, they might

have “a discussion about the nature of design research” or “an interesting debate about the role of TU/e Industrial Design academia”. In such contexts, the informality brought by less constrained meetings creates opportunities to discuss organizational matters easily that bring about changes in the work environment.

“I think a lot of the bottom up changes that happen in our faculty have their roots in informal meetings [...] we started the X council because of discussions of PhD students that were happening kind of informally and definitely they were about work-related things and culture here at the faculty and from that it grew a need.” - PC#1

4.5 Cultural differences

According to a survey launched in November 2018 [35] the TU/e academic landscape is highly culturally diverse, comprising of 91 nationalities and the Industrial Design community is by no means an exception from it. Although TU/e Industrial Design has a clear vertical organizational structure, the relations between community members are not bound by it.

Researchers and students work closely and sometimes collaborate on projects and students are encouraged to consider their teachers as mentors who guide and assess their progress, rather than their superiors.

However, while this approach is aimed at encouraging proactive and independent learning, there are foreign students, especially the ones coming from Asian countries who do not feel at ease within this context.

In the context of community access and participation, one respondent explains how they sometimes feel inappropriate to the social context due to cultural differences:

“in our culture if you talk to people older you should show respect but here people are more equal so it’s a bit weird when I talk to someone in a casual way and then I found they are a PhD or professor”.- MS#2

Another person considers that cultural differences stand in the way of being proactive and approaching other members of the community:

“From a place where we respect the seniors ...it’s really hard to approach them (academic staff); I feel I cannot really connect with them” . - MS#4

On the other hand, there are people who turn cultural differences from boundaries that prevent community access to challenges they must overcome to become better social networkers:

“I think maybe I have to cross some cultural barriers and talk with people from other cultures too.” – BS#2

4.6 Peers flock together

According to our respondents, both students and staff extend their work-related interactions to informal encounters by connecting preponderantly with their peers and direct social links. For example, during informal

encounters they meet and “just catch up with a friend after vacation”.

When asked to recount the last meaningful informal interaction they had with a community member, one student participant explained:

“It was today with mostly people that I already know. People that walk by and see me sitting here and stop for small conversation or they have a problem that they want to talk about.” - MS#5

For researchers, the situation is similar:

“A colleague, he wanted to show me something and he showed me on his laptop. It was work related.” AP#2

The interactions they have, even the ones which happen in more relaxed circumstances, are on discussion topics that stem from the work environment:

“During lunch today, with colleagues. We had an interesting debate about the role of TU/e Industrial Design academia.” -AP#1

One participant explained how collaborating on projects builds social relations that are fed by these repetitive activities and common goals fellow co-workers share:

“Mostly [I interact with] my colleagues that I sit with; there is 3 girls that we all started in the same year and going through the phases of trying to discover what a PhD is and sort of getting the hang of it... we talk a lot firstly because we have a lot of the same work deliverables” – PC#1

Similarly, another explains how sharing a specific space inside their work community daily forms bonds that extend over work-related activities:

“ Because we sit together, we usually go to lunch together and that becomes a more informal moment where we talk about more personal things.” – PC#1

4.7 Limitations of the open space

In relation to the floorplan layout from Atlas, members describe it as “a very particular space very much unlike an office” where “there is so much going on”; they “don’t really like the open space to be honest” or “ have mixed feelings about the building” and a reason could be that they “get disturbed by the professors talking there every day”.

They consider that “in an open space you are easier approached” or that the current arrangement is “not in sync with how I typically like to use buildings” and they feel that the building “seems to have forgotten that people need to use it”.

The user opinions and experiences regarding the use of space are variegated: they pendulate between anticipation regarding a newly founded community hub and an overarching sensitivity towards interruption from their work:

“I feel like when I come to this building, I will probably meet people that I know, and you start talking and keep distracting yourself. So, if I want to do something with focus, I would go to Metaforum because I am less likely to meet people I know.” - MS#1

Some blame the difficulty to concentrate on the inherent usage norms that come along with a typical open space, and

not the users who employ them inappropriately in this context.

“First of all, you need to know that I am sitting in the open space; this is a very particular space very much unlike an office; so, my assumption is that people feel that < he is sitting there, it is a bit noisy anyway, so he wouldn’t mind a chat>.” -AP#1

Similarly, noise amplification is considered an inherent problem of the open space that makes some of the users feel unsafe to conduct meetings:

“This building has an unexpected way to amplify sound. [...] The people at the fifth floor can hear what’s being said on the fourth floor. And sometimes when you have a meeting in that corner, I can literally follow it into the other corner of the building so that is something that does not always make me feel safe.” -AP#3

Moreover, they are continuously disturbed by others with whom they share the workspace and they blame the spatial design which affords intolerable user behaviour:

“I received the newsletter and they say that we should keep quiet and not disturb the staff working. But I get disturbed by the professors talking there every day...I don’t want to disturb them, but don’t disturb me too. For example, this space is more open because it is near the door, the lab, the coffee machine [...], you can talk and work, but at the back it should be quiet. However, every professor goes and talks there. If people could make this clear, then it would be better.” - MS#2

4.8 Opportunities in the open space

There is a positive side to the transparency provided by the open space layout in relation to social connectivity. The open space offers “this opportunity for people to walk by” and some members consider the open space a good setting for serendipitous encounters:

“Because it’s open space you have this opportunity for people to walk by [...] you are easier approached. In my opinion, when I don’t want to be bothered also sit in one-person spaces or try to get a cabinet or a room.” - BS#3

The open spaces from floors 2, 4 and 6 offer 6-person snack tables which are considered a good setting for informality during breaks:

“I really like the idea of the pantry lunch location on my floor (4th) and I would like to see more of these informal lunch and meeting places.” - BS#4.

They consider that: “At the pantry, level 4 is where the most encounters happen because the teachers are there too” and that the pantry table location is a good indicator for approachability:

“Obviously people are available when I encounter them at the lunch table. I guess sometimes context is important.” - MS#2

A member describes the pantry area as a location that conveys the idea of break from focused work and leaves members open for interaction and unplanned social meetings:

“If I am sitting over there [the coffee machine] and heating my lunch waiting for the microwave to finish, I think that’s fine [to be approached for a chat.]”-PC#1

Lastly, the pantry area is considered as a location in the open space that encourages social interaction without disturbing other activities that take place in the workspace because it affords a specific activity:

“About the setting [...] at the coffee machine might be better [for social interaction]; if I want to have a beer I prefer to do that off campus or in a location where I am not intruding on the other social climate that is happening ...I feel like location is so specific.”- PC#1

4.9 Community building requires a community space

The TU/e Industrial Design community members consider that the newly renovated Atlas hinders community building instead of facilitating it:

“This building breaks it up because it doesn’t facilitate community building. Potentially it does, but not how it is turning out. It sort of distributes facilities and ignores the actual use and it seems to inspire disparate communities.”- AP#3

They wish a common meeting space that belonged to the department existed and do not consider the cafeteria from the ground floor services area a good choice because it is shared with other departments and it is expensive:

“I don’t really meet people, there is not a big, fixed space for talking. Because before, we had the canteen and the closed space only for ID students but now the canteen is expensive, open to everyone, so I can’t really meet anybody.”- MS#2.

Furthermore, when comparing Atlas with the previous building which the department solely occupied during the renovation, users seem to long for a lost sense of identity:

“I realized what I liked about the other building is that it was our building and it was friendly. And two floors nothing fancy. It was a good feeling.” – AP#2.

Moreover, it is not only the TU/e Industrial Design cafeteria users feel to have lost, but also the student association space LUCID which used to be frequented by students and staff alike:

“I hardly go there now [LUCID]. Probably because I need to take some more stairs because LUCID is in the basement now. There was still much better in the old building or the Laplace building.”- AP#2.

In Atlas the two social hot spots of the department are no longer integrated in the daily routine of the users, making them have a limited success in coagulating community feeling:

“In Laplace, when you went to the canteen or you walked to LUCID or there was always a chance of meeting teachers and seeing them at the lunch table and they were like really the same level kind of. This is not the case anymore.”- MS#4.

Furthermore, as a result of the building failure to attract and engage users during breaks, users feel isolated from their peers:

“In Laplace if I wanted to meet someone, I took a round and easily found them. Now in Atlas, this is really difficult to be done. Sometimes, I feel isolated from my fellow students.”- MS#5

Lastly, the members of the TU/e Industrial Design community feel that the department does no longer provide a common space of socialization and they express their need for new opportunities to be together with their colleagues:

“I see other teachers smoke and that is the only space that we can share or do something else than work; they have their own spot for lunch, for everything; except for squad meetings, everything is separated. That is the only space where we meet but we don’t talk; there is still a distance. We need a space where everybody does the same thing that is not work.”-MS#3.

4.10 Contextual planning & informed conversation starters

This study has been conducted in a community of creative thinkers; therefore, we have considered appropriate to ask them to describe at least one improvement they would bring to the current situation in relation to their community.

The first category of ideas originates from the inconsistency and discontinuity that the staff experience in relation to their work schedule, as one respondent explains:

“Over time I learned that the schedule for staff members here is super fragmented. I already have very limited time and opportunities to do focused stuff and over the years I’ve come to understand this. And so, I also learned that people appreciate clarity.” AP#2

This clarity could be brought on by an organizational restructuring measure, another user adds:

“It would be nice to organize things in a contextually similar way; for instance the Fridays are relatively ok for me because I stay mentally in this student coaching space; I do it in the morning, then it is a short break or no break and then I continue in the afternoon like 1-8 meetings and then the day is done; but I don’t need to jump around and switch context.” AP#3

The problem with switching contexts has been similarly described by the TU/e Industrial Design Education director, who explained in an interview that the community bonds between all members could be effectively improved if the staff would be able to contextually combine and adapt their weekly activities. He added that staff members have multiple roles within the department that emerge from a diversity of activities such as research, teaching, mentoring and for some, administrating and organizing.

These roles are currently performed in a fragmented, almost chaotic manner over an entire week which causes task accumulation, increases stress and consequently, decreases the chance for spontaneity and informality between breaks. Another participant describes this situation from the staff perspective, when asked to give their opinion on starting a community building activity on Friday morning:

“I can’t keep on stacking that up, and certainly not every Friday. What for you feels as community building and as intrinsically valuable and I’m not arguing with that is also an organized thing that brings me every Friday away from my family [...]. Everything I don’t do in the thirty-eight hours that in here I’m doing in the evenings. So, if I’m going for some community building for an hour or two every week, that means that I’ll work an hour or two more in the evenings”. – AP#1

The second category of ideas arises from the impracticalities the students experience when they want to access academic staff they are not acquainted with. A student characterizes the current situation:

“I know most of the teachers as I know them from Facebook... [laughs] but it doesn’t count, you need SOMETHING ELSE.” – MS#1

They describe their needs and propose improvements in relation to information on availability and location of staff members:

“The first obvious thought I have is the kind of app that would show you where people are and also if they are busy...like if my teacher is there and if I have a question and they are not super busy its ok if I come in to ask it...who is there and where and if it’s an OK moment to approach somebody.” – MS#2

They mention that their expertise is insufficiently detailed on the TU/e Industrial Design department website:

“even if we have this staff description on the website where you find out their expertise and whatever, I find it a bit hard to really get valuable information from there and see who might be interested to talk.” - MS#4

Similarly, they would like to get more in-depth knowledge of past projects they might be interested in:

“The projects they did, that is interesting to know as well. If I know the person and I know the interest they have, then I would start a conversation. I think you need to search sort of the same interests to start the conversation”. BS#4

Lastly, the third category of community improvements regards the students’ active role in making their needs known and attracting valuable discussions. To stabilize the unidirectional flow of information that is currently available from the academic staff’ side, students should become proactive and start displaying their work in a similar way as their teachers. This idea has been initially described by the TU/e Industrial Design education director as “conversation starters” when he stated that “students should be cleverer about it” and confirmed by one of the participants interviewed:

“The more proactive the student is and more go-getter they are... if they schedule a meeting request and already have a sketch and show you they read a bunch of stuff, that excites the staff here and then they are more open to spending more time.”- PC#1

5. Discussion

5.1 Contextual planning (based on themes 2, 4)

The TU/e Industrial Design knowledge space is divided into 6 floors with limited and onerous communication in between them which hinders accidental meetings between colleagues. This is especially the case of researchers whose daily activity is densely structured around formal meetings and focused, individual work. This situation does not leave many opportunities in their schedule for informal encounters. People cannot be motivated to contribute with time and knowledge to the academic community when their entire schedule is overloaded and fragmented.

Therefore, decreasing the burden of staff activities and tasks by contextually restructuring teaching and research and organizing smaller clusters of similar interests can improve knowledge work and community relations. This can be achieved by providing better alignment between student projects and research activities and arranging thematic areas within the building supported by online groups for fast knowledge exchange.

5.2 Everyday navigation in a boundless physical & digital space (based on themes 1, 3)

Availability during everyday working hours is considered a piece of information with a high potential to either strengthen community bonds or break them even more. Members rely on their personal interpretation of generally accepted rules of availability or common practices in knowledge workspaces to understand this information.

They interpret digitally available information through the TU/e intranet platform or email exchanges. Physical elements that display availability are used by staff members to enforce a distance from others during their work. These are construction elements or furniture pieces (doors, walls, desks) with general norms of use attributed by people through personal interpretations, experience and cultural practices. The norms and practices for the same element can be interchangeable, one taking priority in front of another as a result of everyday use.

Keeping clear boundaries and creating easy-to-follow rules in the physical environment as well as displaying online up-to-date information regarding the availability, location, work context, activities and interests of users could increase work efficiency and improve community experience.

5.3 Opening the open space (based on themes 7,9)

The majority of TU/e Industrial Design users collaborate, learn, focus and socialize in the open space areas located on floors 2, 4 and 6. These spaces provide a mix of individual desks, shared working tables clustered in squad spaces, meeting spaces of different arrangements

and sizes and a small pantry area for lunch and quick meetings. They are all positioned in an open space floorplan layout with very few space partitions to provide noise control and visual separation between the various types of activities happening at the same time.

Moreover, having multiple activities and interests combined in an open environment brings difficulties for those who want to conduct focused work. This situation can be regarded as a conflicting agenda between the intended use of the space and the daily practices which point to either a lack of communication or a design fault or both. Creating a welcoming working environment that affords diversity can be achieved by increasing the number and types of space partitions, adding noise cancelling devices or considering remote work through an online real-time collaboration platform.

5.4 Open space – opportunity to collaborate, socialize and interact in small groups (based on themes 6, 8)

Working in the open space does not only mean noise and interruptions from focused work, it is also an invitation to collaborate and to exchange ideas, to meet, to see and be seen or to just sit in the same space with others like you.

Even when they do not actively participate to a formal meeting or collaborate with others, members can still encounter moments of community [10] by observing others, identifying with their actions and appropriating cultural practices of the knowledge space.

This is possible because the social environment is situated in a space with few boundaries, multiple seating possibilities and flexible furniture which afford in term multiple activities at the same time. Therefore, we consider that combining possibilities for interaction within different group sizes and types will improve social connectedness and create the opportunity for socializing, pitching or venting.

5.5 When everything is accounted for, there is not any place left for surprises. And communities thrive on surprises (based on theme 10)

Community building in an academic knowledge space is a continuous effort that requires a balance between planned spaces, organizational measures and activities that cater to all members ‘needs and unplanned circumstances that leave room for uncertainty and togetherness [16]. The TU/e Industrial Design department is a vivid example of how a tight academic community can dilute in a matter of months when displaced to an environment which is unfit for community activities. In their everyday use of a workspace, people are more interested in solutions that allow them to work and socialize unhindered than in over-planned, cutting-edge, visually pleasing designs that fail to afford the simple joys of being alive (“There’s no surprises

anymore and we thrive with surprises. And if everything is planned and fixed on, people will go home and work from there”). Placing (seemingly) random events and hotspots in people’s way, such as a temporary lemonade stand, an art display area or an information panel can increase informal encounters, improve orientation and create joy.

5.6 Cultural awareness (based on theme 5)

In an academic community, social and cultural integration of students is important for a good academic performance [36], but being close to other members is not always an easy task for foreigners, especially for those coming from Asian countries.

According to a recent study conducted in nine academic institutions in the Netherlands, this reality stems from the differences in power-distance [37] that students must adjust to when they start university courses. This reality has been confirmed by respondents to our study coming from Eastern Asian countries; according to them, the most prevalent cultural issue is the (lack of) seniority in the TU/e Industrial Design community. If normally, this would translate into lower thresholds for both informal and formal interactions, in their case it is an issue that makes them feel out of place.

Consequently, their own cultural values collide with the institutional culture and practices, leaving them with a hard choice to either ignore their own cultural identity and values or to ignore everyday academic conventions and thus, become gradually excluded from the community.

Culture is a sensible topic within academic communities. While a universal recipe for success does not exist, members who are aware of the cultural implications of their interactions already have an advantage over those who ignore them. Similarly, if the academic institution would be more flexible in accommodating foreigners by actively encouraging cultural awareness [37], they could become more active members of the community.

6. Limitations and future research recommendations

This study has been performed in a recently renovated, state-of-the-art university knowledge space which has been designed to afford community building within departments through social learning and experimentation, as well as a flexible and enjoyable work experience for all knowledge workers involved. Thus, we consider it representative of the research topic addressed. However, the research explores a singular case study which cannot provide generalizability of the findings. More research in other similar knowledge spaces is needed to generate a better understanding of how community building should be encouraged in academia.

Moreover, the exploratory nature of the study which builds only on qualitative data provides rich insights into the multi-faceted challenge of designing modern

knowledge spaces. However, to support the validity of our findings a quantitative study that addresses the topic of user experiences of academic knowledge spaces in nowadays societal context is necessary.

The main researcher of this study is a member of the community which is being studied; therefore, the data collection process has been strongly influenced by own daily experiences and insight. On one hand, this situation provided a better understanding of the context which in turn saved valuable research time. On the other hand, researcher bias could not be avoided entirely, and we are aware that several discussion topics have been brought up because of our familiarity with the environment. However, we trust that the data analysis process has been sufficiently supported by theory and bias has been removed from this subsequent part of the study.

7. Conclusion

Following a qualitative stakeholder approach, this case study explores the community of the department of Industrial Design from Eindhoven University of Technology, The Netherlands to understand how state-of-the-art academic knowledge spaces foster community – building in today’s latest technological context. The findings are comprised in 10 context-rich themes which indicate that the analysed knowledge space does not meet the conditions required to encourage community building on three main aspects: providing rich-context information to users about their peers, a balanced combination of work and community activities among academic staff and a spatial design fit for serendipitous encounters, large-group gatherings and eventful routes.

As suggested by the thematic analysis, the environment plays an important role in creating opportunities for community building, thus we recommend exploring this in more detail as further research on communities of knowledge work. The emergent discussion provides useful suggestions on ways to support community building for corporate real estate management experts, as well as interaction designers, architects, planners, or other professionals interested in applications of ICT on academic knowledge spaces and smart city infrastructures. The study expands the literature on academic knowledge spaces by placing emphasis on community building and participatory communication in the context of smart cities. Further research is needed to support our findings from a quantitative perspective as well as from other universities which undergo restoration and/or restructuring works on their facilities.

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