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Learning bodies: Sensory experience in the information commons

Abstract

Despite the digital shift, university libraries have grown in importance as places where students come to learn. Interest in designing better spaces has led to a flowering of user experience studies. Such research into how students use library space could usefully be informed by the theory of embodied cognition, which emphasises the role of the body in thinking and learning. This study explores students' embodied experience of an information commons building. Data were gathered from participatory walking interviews, where students were asked to give the interviewer a guided tour of the building. Findings revealed the way that particular combinations of sensory experience contributed to particular forms of learning. Very small movements or choices seem to reconfigure space significantly. This research also draws attention to the way that different learning atmospheres are actively constructed. The findings contribute a new perspective on inquiry into the use of library space. The potential implication for libraries is the need for more fine grained analysis of use experience from a sensory perspective and for teachers and learners to more explicitly reflect on the role of the body in learning.

1. Introduction

One of the key events shaping the design of libraries in the middle ages was the diffusion of the revolutionary practice of silent reading (Saenger, 1982). Silent reading enabled reading rooms to be created; faster silent reading also meant shorter loan periods. Yet it was also a subversive practice because it meant people could no longer know what one another were reading. However, later in history, maintaining silence was part of the public library's "civilising mission" to the working class. Enforcing silence was an act of social power (Mattern, 2007). This is perhaps partly why the public image of the librarian telling people to be quiet is so embarrassing; it constructs the librarian not only as a kill joy but also a mediator of class based social control.

In the academic library context, theories of social learning have driven us away from the rule of silence with the design of information commons and learning commons. Sound levels remain controversial, however. In the face of potentially noisy "domestication" (Bennett, 2005), Gayton (2008) asserts the continuing need for quiet in the library. "Communal activity in academic libraries is a solitary activity: studious, contemplative and quiet" (p. 60) in the presence of others, but not necessarily social and interactive. To balance this tension librarians have become rather skilled in managing noise levels through architecture, furnishing, and policies (Yellinek & Bresler, 2013). Library practices have effectively moved away from enforcing silence to creating complex soundscapes (Mattern, 2007), though it is evident from the work of Sequeiros (2011) in public libraries that readers themselves also actively participate in constructing a reading atmosphere in libraries.

If sound is a key part of the experience of using a library, what of the other senses? Asking questions about the importance of sensory experience in library spaces is in tune with a growing interest in the body in learning (Bresler, 2004; O'Loughlin, 2006). It is increasingly recognised that the tasks that most people come to libraries to do, the most fundamental learning activities such as writing (Clughen, 2014) and reading (Mangen, 2014; McLaughlin, 2015), are in a profound way embodied. For example, McLaughlin (2015) explores how reading is different in different places, be it the park, the subway or at home. In his consideration of libraries, he emphasises the model of the library as silent space efficiently designed for reading as serious work. New types of library space presumably create the possibility of different types of serious reading or learning.

Such perspectives reflect new thinking around the notion of “embodied cognition” (Robbins & Aydede, 2009; Shapiro, 2017; Wilson, 2002). This posits that cognitive processes involve the whole body, not just the brain. For example, gestural cognition suggests that hand gestures are not only a means of communicating, but also part of thinking processes. Even abstract thought seems to be enabled by such gesturing. Embodied cognition suggests that rather than being centralized in the brain, thinking happens across the whole body. In very practical terms this implies that certain types of learning might be promoted by movement, for example. Many authors have suggested that their best thoughts come to them when walking (Clughen, 2014). This prompts questions as to the ways this embodiment of cognition affects how libraries are used and should be designed?

A further inspiration for such questions could be sensory studies. Sensory studies chart the fundamentally different meanings that have been attached to the senses through history and across cultures (Howes & Classen, 2013). They also interrogate the power implications in the sensory order of societies: the way that particular sensory experiences are privileged and others deprecated. This perspective has potential to inform our understanding of embodied information behaviour (Cox, 2018b).

1.1 Problem statement

While there is currently great interest in the design and use of physical space in libraries, little of this work has been informed by the notion that the body and senses are essential to all sorts of thinking and learning. In this context, this study explores the sensory experiences of library users, and how this links to their learning. More specifically it is guided by the following research questions

1. What aspects of the senses are important to students in their choice of study space and how do these relate intersensorially?
2. How do these sensory aspects link to social conditions and affect?

2. Literature review

2.1 Library space

The current century has seen an intense interest in space in academic librarianship. This concern has partly been driven by shifting pedagogies (Jamieson, 2013). Constructivist, including social constructivist, models of learning require the learner to actively engage in the building of understanding. This prompts rethinking space because learning based on independent study or group discussion, typical of constructivist pedagogies, requires a different configuration for individual reading. The discourse of student centred learning also reflects commercial drivers. The quality of campus buildings such as the library often seems to be significant in students’ and their parents’ choice of an institution. Much of the research on library space has been prompted by refurbishment and new building, presumably premised on a return on investment in terms of student numbers and satisfaction. Indeed, Closet-Crane (2011) sees the student centred discourse used in writing about library space as implicitly linked to the spread of commercial thinking in academic libraries.

Technology has also been a major driver and enabler of library design. Digital formats enable space in the library to be freed up from book stock for other uses. Rather than this liberated space being filled with ranks of computers, the trend to bring your own devices and wifi access enables more flexible designs and makes greater mobility possible. Technology has been an enabler, but is also a threat in that while digital formats liberate space, they create a problem for libraries so long as libraries are still identified with a book collection. Thus the reconfiguration of library space also reflects librarians’ need to reinvent library identity in the digital era. The agency of librarians as a profession, led by thought leaders such as Scott Bennett, in reimagining the role of library space, is also part of how spatial use has changed.

Bennett (2005) reconceptualises the library as a learning commons. For Bennett, central to this rethinking is increased emphasis on the role of others in learning. He seeks to define the

characteristics that produce a “powerful learning environment... achieved as a function of the building itself creating a community for learning” (Bennett, 2005, p. 17). To help grasp the key aspects of such a design he investigated places such as student halls and dining rooms where students discuss their studies outside of class. Such spaces are communal. This prompted him to call for the “domestication” of library space (Bennett, 2005). Bennett’s (2011) analyses make it clear that not all learning is social, and not all social learning involves discussion. Studying alone and collaborative learning are important but so is studying alongside—in the presence of others, but not necessarily working directly with them.

Following from these shifts there have been a number of attempts to systematically articulate the qualities needed in a good library design (e.g., Horn, Lingham, & Owen, 2014; McDonald, 2006). A recurrent theme in such work is the importance of creating many different types of space to match a variety of learning activities and also flexibility so the space can be reconfigured for different uses (Fisher, 2005). Different sorts of learning task seem to require different types of spatial design, yet as May and Swabey (2015) reflect, students often use spaces in ways for which they were not designed, for example, working individually in group work spaces. It is of value to think about how users themselves actively shape the spaces they are in.

The library community has moved away from a sense that a library can be designed from the top down, and has recognized that there is a need to examine how spaces are actually used. As a result there has been a flowering of interest in user experience (UX) and ethnographic studies of library space (Priestner & Borg, 2016). Often within this tradition, empirical studies have identified a number of key patterns in how library space is actually used. Library space is valued; it is somewhere students go frequently in the week, and often for extended periods. Students often have a favourite place or floor, though this is in tension with the idea that different activities require different spaces. Typically, they visit for several hours or longer. The overall range of activities in the library is rather wide, including (May & Swabey, 2015; Yoo-Lee, Heon Lee, & Velez, 2013):

- studying alone,
- working alongside others,
- group work,
- writing assignments,
- writing presentations,
- using the book collection,
- using computers, and
- non work activities such as chatting, playing computer games, sleeping, and reading for pleasure.

Despite the list including non-work activities, study is the main purpose of visiting the library (May & Swabey, 2015).

Empirical studies also indicate some of the features that students say they value in library learning spaces, such as room to spread out, a window for light and a view, certain noise levels, learning resources (e.g., books, computers), a power source, proximity to friends, comfort of furniture, and cleanliness (Cha & Kim, 2015; May & Swabey, 2015). In addition, they identify a more intangible sense of being part of a learning community and a sense of belonging (Beatty, 2016; May & Swabey, 2015). There is a desire for community but also for retreat (Harrop & Turpin, 2013). The ambience of a space is important. Sequeiros (2011), in the context of public libraries, has written about how a “reading atmosphere” implies expectations of behaviour (including what one can do and what sound is appropriate) actively negotiated by the users in interaction with the architecture, design, library rules, and so on. Thus reflecting on library space should involve thinking in terms of how different learning atmospheres are negotiated within it.

2.2 Embodied cognition

The library literature reveals an increasing recognition of the importance of material conditions of study to learning. This perspective could be usefully informed by recent intellectual currents around the notion of embodied cognition (Robbins & Aydede, 2009; Shapiro, 2017; Wilson, 2002). This is a view of human functioning influenced by phenomenological philosophy, but increasingly grounded in neuroscience, biology, and experimental psychology. At base it is a challenge to the Cartesian mind-body division. Thought, it is argued, involves the whole body (and affect). Rather than centralised in the brain (treating the brain as if it were not itself embodied), the whole body participates in cognitive processes. To take a simple example, gestures with one's hands are not just a means to communicate, but seem to be tied to organising thoughts in one's mind, even during abstract reasoning (Goldin-Meadow, 1999; Pouw, De Nooijer, Van Gog, Zwaan, & Paas, 2014). Concepts used in abstract thought seem to be based on embodied metaphors. Openness, for example, as a highly influential concept in library and information science, is clearly an embodied metaphor. If, even in thinking about abstract concepts such as this, cognition is embodied, so bodies are important to all learning, not just to learning physical skills such as sport or artistic performance.

One aspect of the notion of embodied cognition is to see perception as tightly linked into cognition, rather than as a separate system that objectively processes sense data. Rather, perception is an active process, involving selection based on the task at hand. Further, there are more than simply five discrete senses. For example, Tortora (2007) lists ten sensory systems:

- olfaction (smell);
- gustation (taste);
- vision;
- hearing and equilibrium;
- somatic, including
 - tactile (touch, vibration, itch, tickle),
 - thermal sensations,
 - pain sensations,
 - proprioceptive (relating to the position of our body),
 - kinaesthetic (relating to sense of movement); and
- visceral (relating to the internal organs).

Actually the human body has many sensors, so even this overview is a simplification. In addition, the senses are not experienced as separate channels, rather they work together intersensorially.

The implications of embodied cognition for learning arise from the sense that basic learning processes including different forms of thought, such as recalling, and complex accomplishments, such as writing and reading, are profoundly embodied (O'Loughlin, 2006). Clughen (2014) points to the way that many notable authors have linked writing to physical movement, especially to walking. Keinänen (2016) has identified that many academics engage in walking-for-thinking, a type of walking at a particular speed and rhythm. This could have significant implications for how one teaches the academic skill of writing. As one practitioner comments:

Getting participants to engage with their written work in a tactile, visual and discursive way (as opposed to, say the more formal approach of a lecture followed by solo study) provides a sense of enjoyment and discovery, helping to replace some of the negative emotions with positive ones. (Reeve, 2017, p. 26)

Drawing from the same inspirations in embodied cognition, McLoughlin (2015) investigates reading as an embodied accomplishment, involving the coordination of certain patterns of eye movement, dexterous use of the fingers and hands, and particular positionings of the body. All these physical actions actively shape the reading experience. McLaughlin (2015) argues that different environments

and how they shape our reading posture, and the proprioceptive sense of the positioning of the body, create different experiences of reading because of how they influence our embodied engagement with the text. Thus what we understand and feel about a text could be influenced by where we read it—the subway, the park or the bath. Similarly, if we read a work on screen it may be experienced differently from reading the same text bound in book form, at least in part because reading an ebook involves a different set of motor activities (Mangen, 2014).

The most fundamental learning tasks such as writing and reading should be recognised as embodied accomplishments. How the body is positioned to perform them matters and so also does the space that shapes this. Heppell¹ postulates that different forms of learning require different environmental conditions and learning is affected by diet. Reflecting a similar logic, in the theory of kinaesthetic learning Lengel and Kuczala (2010) propose that teaching methods be linked to movement. Beard (2017) agrees that “movement is an essential principle in the design of effective learning. People should ideally move around at times as opposed to sitting, passively” (p. 11).

2.3 Sensory studies

Another inspiration for investigating the sensory experience of the library could be sensory studies. This area of scholarship comes from sensory anthropology and the history of the senses (Howes & Classen, 2013), but a more sociological version has been developed by Vannini, Waskul, and Gottschalk (2012). They coin the term “somatic work” to point to agency in the way meaning is constructed through the senses. For them, the senses are essentially skills, which have to be learned. The multidisciplinary scholarship around the history of the meaning of the senses is well represented by books in the *Sensory Formations Series*, published by the Centre for Sensory Studies². These interdisciplinary anthologies explore the meanings attached to different senses in different cultural contexts, for example, auditory cultures (Bull, Back, & Howes, 2015), smell culture (Drobnick, 2006) and touch culture (Classen, 2005).

In sensory studies the senses are also recognised to be shaped by issues of power. They are seen as hierarchically ordered, with different societies privileging different senses. Western culture has traditionally privileged sight—it is ocularcentric. This is a useful reminder about how issues of social power might play out within bodily experience. The control of sound in libraries is often seen as an act of social power (Mattern, 2007). Many have noted the potential of the library to operate as a panopticon for the way visibility is linked to social control (Radford, Radford, & Lingel, 2018). This prompts questions both about the cultural meaning attached to the senses and the power relations instantiated by those meanings.

3. Method

Research into how students really use space has motivated researchers to change how they collect data about student use of academic libraries, often under the umbrella of UX studies. Interviews and surveys are still used (Bennett, 2011; May & Swabey, 2015; Yoo-Lee et al., 2013), but many more novel, ethnographic, creative, and participatory methods are being adopted: especially observation (Bryant, Matthews, & Walton, 2009; Hunter & Cox, 2014; May & Swabey, 2015; Priestner & Borg, 2016) but also photo based methods, mapping (Harrop & Turpin, 2013) and cognitive mapping (Delcore et al., 2009). The study reported here uses the same interpretative methodology that such new methods adopt. Building on a previous study in the same context based on focus groups and interviews (Cox, 2018a; Cox 2018b) it uses the participatory walking interview method, with six students and two members of staff. Walking interviews, as the name suggests, invite participants to take the interviewer on a guided walk through a space that they use, and to talk about their experiences there. It is essentially a variation on participant observation (Kusenbach, 2003). It has been used in a number of social science fields (Clark & Emmel, 2010 Evans & Jones, 2011; Henshaw,

¹ <http://rubble.heppell.net/>

² <http://centreforsensorystudies.org/>

2014; Pink, 2015), but only in a limited way in the information field (Cox, 2018a; Polkinghorne, Given, & Carlson, 2017; Thomson, 2018).

This data collection method is well suited to the study of learning spaces, but like any method it has its own strengths and weaknesses (Carpiano, 2009; Dubé, Schinke, Strasser, & Lightfoot, 2014; Jones, Bunce, Evans, Gibbs, & Hein, 2008). One strength is that it gives the participant some agency in the research process. It immediately shows an interest in the participants' own perspective. Because it moves the interview into the spaces relevant to the activity under investigation it is likely to be able to reveal more in-depth everyday experience and to elicit spontaneous responses. Thoughts and memories are stimulated by being in the place that is being investigated. Much of the experience of space is tacit or unconscious; it is far easier to articulate when located in the context itself. In particular, it is far easier to elicit comments on sensory experience in a specific locale, rather than in an interview abstracted from the location being studied. It is particularly relevant to exploring sensory experience, because it is hard to recall the detail of sight, smell, or sound out of context. Previous literature indicates that aspects such as light and sound levels affect student satisfaction with library spaces, but this approach sought to delve more deeply into how these features are experienced and how that might be linked to learning. In this case students were asked to give the researchers a tour of the building from their perspective; question prompts were about sensory experiences. A total of eight 40 minute interviews were conducted and the recordings were transcribed. A thematic analysis was conducted, driven by the balancing of prior theoretical interests in the relation between space, the senses and learning, and an inductive concern to allow codes and themes to emerge from the data.

3.1 Case study context

The study was undertaken at the University of Sheffield, a research intensive university in the UK. Sheffield has about 27,000 students and 1500 academic staff. The space investigated was the Information Commons building, familiarly known as the "IC". Opened in 2007³ it was one of the first new types of learning centre in the UK designed to combine in-demand texts, computing facilities, a wide range of types of learning spaces, and 24/7 access (Childs, Matthews, & Walton, 2013; Lewis, 2010). It was conceived as an integrated learning environment, allowing digital and print resources to be used in tandem. The original design sought to create nine distinct types of learning space, to which a tenth was added after opening (Lewis, 2010). An effort was made to avoid a linear alignment. The popularity of the IC as a study space has meant that high levels of occupancy have always been a key challenge. The campus contains a number of other library related buildings, including a more traditional library (Western Bank) and a learning commons, the Diamond, opened in 2015.

4. Findings

4.1. "The spot"

Students often have a favourite place in the library they return to if they can. What does this look like when considering such preferences in sensory terms? One participant gave an extended description of her favourite place, which she had dubbed with her friends as "the spot":

Having tried different places, I found "the spot". It was in a corner, close to a window, so it was naturally light. It was a big table with a computer and I could easily place my laptop and books next to me. Also, it had a desk light which allowed me to turn off and on. A few times during breaks, I turned the light off to rest my eyes from having looked at the monitor for so long. If I was unable to turn the light off, I would have been forced to move away from the table and rest elsewhere. I liked to see other students working. I could see some students working individually, in a group, using the computer, personal laptops, sitting at the table, on comfy chairs, sitting on the floor between book shelves. The spot was

³ <http://www.shef.ac.uk/infocommons/history/index>

close to book shelves and it had a library touch. I felt I could see others easily, yet I could not be seen so much.

Thus, as one might expect, in a favourite location the quality of light is significant. The spot has both good natural light and a lamp. As well as light levels, what can be seen in the surrounding area is important. It is motivating to see others working; in the spot, it is the variety of other activities that are visible that is valued. At the same time as wanting to see others working, not feeling oneself exposed to others' view too much also feels important. As well as light quality, and what is visible, one's own visibility is also significant.

The type and amount of space seems important. Being in a corner gives the spot a sense of enclosure. Having sufficient space enables the student to spread out with laptop, books, and the desktop computer. Control over the environment is also important, not only simply in the freedom in choosing a spot, but also because the student can adjust the lighting. However, the choice may also reflect the context of competition for space. The student would rather not move because she might lose her place. So as well as the pull of the preferred space, this may explain why students often settle down for a long time in one place.

She continued describing the spot later in the interview:

It is not too quiet and it is not too noisy. So you can concentrate. And for me it was important to at least have a bit of background noise... here, because they have separated with those screens behind the computer, it is kind of a separated [...] and you can almost merge with everyone else but you have still got that privacy. It had the shelves next to it and I felt almost protected by the shelves. So on one side I felt protected and on the other side I could see other people and hear that noise and all I needed to do was to turn my chair. If I needed to concentrate more, I would turn more towards the shelves and if I wanted like during breaks or if I was not concentrating as much, I would then turn the other way towards other people. So you could almost control the noise, depending on what you were doing. And it is a relaxed area. So you would see people working really hard, but if I once or twice what I really loved was ... when I turned towards the shelves and there was this girl sitting between the shelves you know with her legs out and she got her bag next to her and she was reading one of the books. And I thought it is a really relaxed area for her and I really liked that because at one side I could see her really relaxed, and then turning the other way other people were working away on the computers. So again, you could turn different directions and see completely different behaviours and feelings ... But this space had it all going on. So even though it was 'the spot', if I needed to concentrate a lot, I would face the screen like that guy is doing. But right around the corner is, if I was working in a more social way, talking to other people, I would sit facing others down there. So I would sit round the corner. So 'the spot' was like three specific seats.

Thus as well as a particular order of light, what is visible and one's own visibility, sound matters as well. Rather than silence she prefers a little background noise. Again the ability to control sensory experience is valued. Small repositioning can change what is heard, as well as the view. Perhaps what is important is that this involves both filtering out of sound and creating distance from others. Simple positioning of one's own body could be enough to exercise control. The subtle combination of sensations is also associated with particular affects, such as relaxation and comfort.

The student's words also reinforce a sense of a desire to be enclosed. Library shelves, rather than being just places to store books, create protected spaces, potential territories. Her sense of ownership extends to her delighted naming of "the spot". The desire to control space is in tension with a desire

for belonging, expressed by her feeling that you can “almost merge with everyone else”. It would seem that it is not just light, what is seen, or noise type and level, but also the proprioceptive sense of spatial openness or closure that affects learning activities.

Another interviewee made a different type of link between the proprioceptive feeling of space and learning.

I think that is a good desk because there is a lot of space around you and I know it sounds weird but the more physical space to me, it creates thinking space so I think that is why I prefer the Diamond because it has headroom. I know that sounds absolutely ridiculous, but to me the IC feels quite closed. Like these bits, I know it's a normal height, but it feels much nicer to sit here ... and I prefer to be slightly away from people, I do not like people to be sat in my space. With that table you can see that there is somebody nearby but they are sat at an angle, they are not in your vision, it is like you are on your own basically. Just realised how weird this is. [...] It feels that the Diamond has more natural light, it has more headspace, the ceilings are higher. It deals with the sound better. I do not know how or whether they have designed it like that or it is just me, but it definitely feels like it is ambient noise with all the chatting. It sounds totally different to here.

Rather than seeking containment, here the student values a proprioceptive sense of headspace that seems to arise from a combination of ceiling height, sound quality, and also a sense of social distance. Again it involves a choice of a precise body positioning: sitting at an angle takes others out of view. The metaphor of headspace seems to suggest that thinking is freer and perhaps more expansive where there is more physical space. So there is an intriguing suggestion of a link between a quite specific form of cognition and a specific sensory configuration.

This proprioceptive sense of space cropped up in other interviews:

So I used to always work on one of these desks, normally the end section. I quite liked it because ... you have got enough light but it is not a massive open space ... Got to have some sort of not confined but not vast sort of room. I did find it got too noisy, but I brought some headphones to cancel the noise out and that made it quite a comfortable place to be.

Like the first interviewee, but in contrast to the second, a sense of physical containment seems to create the environment for focussed thinking. As well as the space being not too visually open, sound is controlled through headphones. Another interviewee commented:

I feel that way about the second floor because I think [it] is much more cramped than this one. So it just feels a bit more kind of classic Uni environment while this is more open, the mood of the second floor is quite different to these. There are also less windows there, a bit like Western Bank [the more “traditional” library building on campus] and people treat it more studiously because of the lack of windows. It is sort of being locked in a little bubble. And you work in the dark really hard and then you go outside and you can do live things. The second floor is just darker and smaller and the books are like closer together. I do not know if you noticed but the shelves are closer so it feels a bit more like what you think of classic library environment where you are appearing between the shelves and that kind of thing whilst up here it is more spacious.

Again a combination of windows and light, density of shelving, and ceiling height creates subtly different spatial feelings that affects the mood of the space and seemingly how people work.

The first interviewee talked about the view of what is seen around one within the building as important. The spot makes visible a wide range of learning activities. Outside views are also important to how a building is experienced:

It is quite nice there because you can look out the window, so I quite like that because it is, seeing the day passing I find that quite useful if I am studying... It keeps me aware of the time passing and it feels quite calm seeing trees or whatever. And in that sort of corner people are not walking backwards and forwards, so you do not get that distraction in your eye line.

Time passing can itself be seen as a sensory, embodied experience. Somehow for this student it contributes to the ability to study and to a sense of calmness.

A view outside the library could help, though not everyone liked this:

I asked him once I said “why do you always sit by the window, is it because of the light?” And he said “no, [it’s] because I do not want to remind myself I am sitting in the library, I want to separate myself by looking at a nice view as if I am sitting outside”. But for me it didn’t work because it was too distracting... Actually it was the opposite for me, I needed that feeling that I was in a library to make myself concentrate and work. The only reason I did not stay at home or go anywhere else like a coffee shop or somewhere was because I needed to see other people working, to motivate myself more to work.

The interviewee contrasts their own need for visual containment for concentration with a friend’s enjoyment of a view that took them out of the situation.

4.2 The library soundscape

It is evident that the soundscape in the library was important, as well as the ability to control this and other aspects of the environment. An obvious way to take control of the sound was to put on headphones:

I generally just listen to music, or it is just the way that I find it helps me personally concentrate on what I am doing... I like to sort of be on my own if you like and doing my work. And if I did not have my music on, then I can hear other things going on, I can see what other people are doing here, typing noises and stuff. And hearing typing noises you would be like oh someone else is working harder than I am or like they are writing and I am not writing... You obviously always hear the printers, people eat food, people drink things which tend to make noises, squeaking chairs, they are always fun... [A] lot of people are very clunky typers, like I know I am a loud typer I make lots of typing noise. I am sure anyone next to me would be very annoyed next to me, because I am typing. We had book pages turning, that kind of thing ... I just put my headphones in. And sometimes I would not even listen to anything, I just have them in my earplugs instead. Then no one can come over and interrupt me because I am listening to something. So, yeah I like independent study, so I do not like to be disturbed if I am doing something.

Playing music could drown out the tiny sounds other people made. In some way the headphones blocking out what the student can hear means that the sight of people doing disruptive things is less disturbing. What she sees does not register in the same way if she cannot hear what is being done: experience is intersensorial. Removing one of the senses affects the interpretation of others.

There is a strong sense of anxiety attached to the little annoying sounds others might make, reinforced by a sense of competition. The headphones also make a statement to others. They define territory and boundaries, again in the context of competition for space.

Sounds made by others was a key issue, especially talking. The numerous other mechanical background noises that are present in the building were rarely mentioned.

I have sat near people sort of explaining things to each other... maybe people stay quite calm when they are having those kinds of conversations. But if people are chatting about what they did last night or where they are going to go or eating at a restaurant or something, people can get much louder and I think that kind of feels more, it is more boisterous which I think is distracting.

Here it seems that it is the tone of speech that creates the distraction or irritation, not simply the noise level. Work related chat and social chat have a rhythm and level.

In fact, for one interviewee the different soundscapes were experienced as a resource. Moving to an area with a different soundscape immediately changed the mood and thinking.

Does the noise around here bother you?" I think people expect the library to be quiet on the inside, but I think the noise on the outside does matter. Whereas the IC it is kind of like vibrant on the outside, I don't know kind of motivates you to get in there... So if I hear cars, people talking sitting outside or at the entrance, if I am feeling tired, noise is important for me to kind of wake you up and get you ready to start. So I remember I was sitting in the quiet place, in that area on the second floor in the IC and a few times when I needed a break I would actually come outside and sit on the steps on the side here, just to get a bit of like noise and hear things, during a break. Whereas usually people think a break means run away from noise and go and sit in a quiet place ...” What about the sound of this bit? “I like it, yeah. Like the café here you can kind of it is almost like another university building, not so much a library. So as soon as I came downstairs from having worked in a quiet place, that noise was lively and it made you automatically change your mood. It took the stress away a bit because you were hearing noise again and it was like a casual environment rather than oh the feeling of library still is stuck with you. People talking casually not about studies, laughing, so when you need a break, the last thing you want to hear is somebody talking about their work or moaning or something.”

The IC is experienced as defined by quietness, yet the soundscape within which the building is set can contribute to the study experience, creating a source of energy at one moment, and release at another, just as the views into this landscape from within the building can play a role.

4.3 Other senses

It might be expected that sound and sight play a key role in the experience of the library. Less obviously, it seemed that other senses also played their part.

Do you think it smells here? “It is an open area, this area. So I liked it, it never felt stuffy or sweaty or too warm or too cold. It was an open area and it is open around you.” Right, so has that got a bit of draft or? “Yeah, so it does not stay constantly one way. So it is almost like clean air all the time. Whereas the second floor, my goodness! That closed quiet area that is the most closed you can find in the whole building, people working in silence, probably too much heat coming out of their head, it is too sweaty, sometimes it affects your breathing I think as well. People were taking a lot of deep breaths, maybe that is part of it.” When you say taking

deep breaths, what do you mean? “Uuh (sighs) or maybe it came with, or you could actually see their chest like maybe that was part of being anxious and getting ready for exams.” Almost like hyperventilating. “Hyperventilating, yeah definitely. I think I experienced that a few times. Sighing, huffing and puffing, you can witness it all on the second floor. I think that is the most serious area of the whole building. I think that is where the library is. [...] This was the deadline room. Everybody is pressured in there. You do not see anybody relaxed, or the times I went I did not see anyone relaxed. [...] There was only a few times I remember I saw people feeling calm and relaxed. Other times everybody was anxious. So this is the deadline room.”

In this description of the silent zone the experience is defined as hot, lacking in air, stifling. In contrast to the open area adjacent to it, which seems well ventilated, but also laid out more openly. Here the desire for compression that some felt helped learning is intensified to the point of suffocation. Anxiety is palpable. Social distance also seems to have collapsed. The silence is so intense that one can hear others breathing and sighing. Interestingly, the interviewee identifies the library with this zone; with the seriousness of deadlines.

Another interviewee commented:

I think the smell, sort of library smell like books and papers and other sort of work products is more strong upstairs. And then you get kind of I don't know more people down here, so just a variety of like perfume and all that kind of stuff, down here. There is just more of like a, this is more of a people smell and the further up you go it is more of like an academic workplace smell.

The deeper into the building one travels, the less the environment has a people smell and the more it reeks of study. The library smells of books and papers. Even in a digital world study is paper based. This was not necessarily experienced as negative, as another interview remarked:

Despite the building having books, the building does not have a book smell. You walk into Western Bank and it hits you the smell of book. When you are there all the time you do not notice it. But if I go back now, as soon as I walk in, I have got that smell. It is a really familiar good smell, and it really hits you.

Just as seeing books on shelves signals a library and the useful affordances for learning that this implies; so also the smell of books and paper somehow convey seriousness.

5. Discussion

5.1 The sensory, social and affective landscape

The IC emerges as a rather complex sensory landscape. Certain areas have a relaxed, light and open feel, with a buzz of activity. Other areas are for some a sort of stifling concentration, at least at certain times. This is in line with recommendations in the literature to design variety into library spaces to allow different forms of learning. In fact, a library has many subtly different spaces defined sensorily, over time. Simply moving one's body, putting on headphones, or turning off a lamp could significantly reconfigure the space. The analysis offered here gives emphasis to such subtle differences and to users' active participation in creating the meaning of space. In creating within spaces—“learning atmospheres,” to adapt Sequeiros' (2011) phrase—sound matters, both with respect to the level and quality of sound and also to control over these, be that through choice of place or blocking it out with headphones. The soundscape of the space around the library building may be a resource just like the views into the surrounding neighbourhood. Qualities of sound, not just sound levels, matter. The visual also matters: the type of light (natural or artificial), the light levels, views inside the building, views outside the building, and also one's own visibility all seem to be important.

Another sensory aspect of learning atmospheres is a proprioceptive sense of enclosure or openness, constructed through windows, ceiling height, the placing of partitions, distance from others, and direction of gaze. And smell, temperature, and air quality also seem to be important too. All influence the experience of space and usually it is some combination of the senses working together—intersensoriality—that has links through to learning. Library literature already identifies these factors as important in student choice of space, but has not explored how they fit together and are actually experienced.

Other people and their visible activities, the noise they make and the extent of social distance are important aspects of this sensory environment. Choosing a place where one is surrounded by others doing what oneself wants to do in some way helps control one's own behaviour, that is, the quality of one's attention to study. Choices of where to sit and where to look shape how this social landscape is experienced. Learning atmospheres are actively created, through socially negotiated (though largely unspoken) understandings of appropriate behaviour. As a result, the same physical point can be experienced very differently on a different day or time.

There is also a strong link between sensory experience, cognitive process, and affect. Emotions in this study seem to range on a scale from calm to anxiety and irritation. Users often seem to develop a strong attachment to favourite spaces and achieve a sense of relaxation and safety if they can find the "spot." In contrast there is an overflow of anxiety where control breaks down, a depth of frustration with the wrong sort of noises intruding when containment and control has been lost. There is a strong sense of a battle against diversion and interruption. Goldhaber (1997) coined the term "the attention economy" to define the battle for attention in an information rich, media saturated environment. It seems the library as a place devoted to certain types of academic activity plays a key role in this attention economy of higher education at the individual level for students.

5.2 The ideal learning space

The findings suggest that there is not one ideal neutral space for learning, in which there is basically an absence of sensory experience, as implied by the idea of a silent library, as if learning could be disembodied, or that there could be absolute silence. Certain types of noise are bearable and even helpful for some activities. The same applies to other senses. Interviewees often commented on the uniqueness of their individual preferences, but probably choices are also linked to task. There could be quite a tight linking between types of cognitive process and space: different modes of reading, writing and thinking happen better in particular sensory conditions. This could be rather fine grained in that very particular types of cognitive task, such as reading in depth as distinct from browsing, are best done under very particular intersensory conditions. A full understanding of this requires much more research.

Interviewees should not be assumed to be making the right choices about spaces to learn in when they expressed their preferences. The interviewee who commented on her own thought being influenced by headspace felt the observation bizarre, reflecting an assumption that thinking should not be influenced by space or the state of the body. It seems likely that at times students do not recognise what the best space is for their learning. It is hard to see the activities in the claustrophobic silent space as representing a good learning experience; it would be surprising if this were defined as good student engagement. Interestingly, learning was nearly always conceived of as happening when seated; the opportunity to move around and think was partly proscribed because of territoriality and the competition for space. The engagement of the sense of kinaesthesia and need for movement were rarely mentioned in the interviews. Mobility seemed low. This is in contrast to the way that some educators have begun to argue for movement in the classroom (Lengel & Kuczala, 2010) and have pointed to the link between writing and walking (Clughen, 2014). Competition for space, the risk of losing a place, and guilt about leaving a space unoccupied even for a short time may contribute to the

pattern of settling in one space for a long period, beyond when it is useful to do so. It casts partial doubt on a positive interpretation of students spending a long time in the library.

Control over sensory experience is also important. But this can take very simple forms: the ability to turn off a light to rest one's eyes, the way that shifting slightly in one's seat places others out of vision, or putting on headphones to block out sounds. Searching around the campus and finding a favourite place could be an undervalued aspect of achieving learning success.

It is widely understood how important library spaces are to the learning experience—notwithstanding the digital revolution. Nevertheless, technological trends have reconfigured this by both enabling people to use devices while mobile and enabling services to be delivered ambiently. The popularity of library spaces is a success story for libraries (Pinfield, Cox, & Rutter, 2017). Yet it is interesting to consider how the library is seen in these interviews. The library is valued as one place to study, but as much at a symbolic level as through the provision of information (or even computing) resources. Books symbolise libraries which symbolise certain modes of learning. Materially shelves are less places to store books than divides that create contained spaces or certain vistas. In some quotes the library seems to be most associated with a serious, even punishing, kind of learning associated with a deadline. This suggests that while valuable to learning, library use experience is not always pleasant.

5.3 Further research directions

There is a need for more research in this vein. The sensory experience of the library and its link to modes of learning deserve more investigation. How far do student behaviours and assumptions about how to learn actually produce effective learning experiences? In particular, the link between specific forms of cognitive activity, sensorial experience, and affect need much more investigation. What types of space and bodily configuration support synthetic or critical thinking, for example? Such studies should sit within wider studies of campus learning landscapes (Dugdale, 2009) or taskscapes (Delcore, Mullooly, & Scroggins, 2009). This further work can begin to answer a bigger question about the part academic libraries play in the sensory order of the university and how this may reflect and recreate assumptions about thinking and knowledge creation.

Given the way the meaning of the body is shaped by society, it is important to recognise the operation of power in shaping such experiences. Several participants' desire to see but not be seen hint at particular sensory needs around safety and visibility. Class and ethnicity shape embodied experience in ways that also need to be explored. For example, what could appear to be neutral sensescapes experienced in the same way by everyone, but subtle cues may convey that the space is a middle class white space. Clearly disability also could directly affect embodied experience of learning in multiple ways. Research informed in this way can reveal a great deal more about which spatial arrangements enable different forms of learning and by implication what critical embodied information literacy might mean. Such investigations would not only be theoretically interesting, but also useful to improving inclusive design practice.

Technological developments may also prompt more such research. In the last few years, in pursuit of the smart campus concept, libraries have begun to attempt to use sensors to measure temperature, air quality, sound and light levels, and patterns of human movement (Griffey, 2018). This will render some interesting insights into the relation between material conditions and how space is actually used. Yet it seems probable that such data will need to be filled out with insights from qualitative work such as presented here to discover how spatial conditions are experienced, explain behaviours, and elucidate their connections to learning. Human perception is very selective, so using sensors to measure sound levels does not reveal what people actually hear, nor how people value or use sound. As moving in one's seat or simply putting on headphones seems to change the sensory experience in significant ways it becomes clear that sensory data cannot, on their own, help to achieve the smart library.

6. Conclusion

Even in digital era, the continuing role of academic library spaces in learning is now widely recognised. Many previous studies explore the design of information and learning commons, or investigate how student users actually use library space. This study offers a new perspective on this important topic employing the methods of sensory analysis. Influenced by both theories of embodied cognition and sensory studies, it has revealed that learning spaces are experienced intersensorially and that cognitive processes seem to be shaped by bodily positioning and other sensory experience. Data elicited through walking interviews proved a fertile approach, demonstrating the value of sensory methods for the study of library space.

The implications of the current study for library practice are to prompt researchers and practitioners to investigate in much more detail how library designs create rich sensory landscapes and to consider how to offer up affordances of choice over study environments. Rather than simply being related to provision of maximum resources and optimal light and sound levels in a space, the key to rich learning opportunities may lie in more subtle sensory configurations. It seems that more differentiation of spaces around the library would open up even more possibilities for different types of learning opportunities. Thinking about all the senses and how they combine moves beyond a simple concern with light and sound levels. It is the fine grained qualities of these sensory aspects and their relation that need examination. There is a need for those who are concerned with library design to sit and walk where students sit and walk. Methods such as walking interviews offer an emic perspective on what makes a positive learning atmosphere and link directly to learning. The lessons are not just for libraries but also for estates managers and for learning space design across the whole of the campus—in lecture theatres as well as in informal learning spaces. The implication for students and university teachers is to think much more about where learning happens and the body's engagement in learning. Discussing explicitly how we think differently in different places would be a foundation for advice given to students about group work and can also reshape how classrooms are used. Reflecting on the impact of space seems an essential element of reflective learning. In particular, we know that movement can aid certain types of thinking, but such considerations have been rather neglected in pedagogic thinking, especially in the higher education context.

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