The Protolib Project

researching and reimagining library environments at the University of Cambridge

Andy Priestner, David Marshall and Modern Human – April 2016
THE FUTURELIB PROGRAMME

Futurelib is an innovation programme exploring the future role of academic libraries within the University of Cambridge. It employs ethnographic research methods and human-centred design techniques to examine the current user experience (UX) of libraries and draws on the skills of librarians from around the institution to test new service concepts. It is funded by the University Library and supported by design and innovation consultancy Modern Human. The programme is managed by Andy Priestner and led by Sue Mehrer, Deputy Librarian, Cambridge University Library.

ACKNOWLEDGEMENTS

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# Table of Contents

1. Introduction 1

2. Methodology 2

2.1 Co-design workshops and LEGO Serious Play 2

2.2 Iterative prototyping and ethnographic approaches 5

2.3 Expert interviews 7

2.4 Data analysis 8

2.4 Statistical overview 9

3. Findings 10

3.1 People choose their working environment based on 3 factors 10

3.2 The intensity gradient 11

3.3 The hierarchy of working activities 14

3.4 Providing a variety of environments is essential 16

3.5 Location and context are important indicators of space use 18

3.6 Provision of well thought out and functional break spaces 19

3.7 People want personal control over their working environment 20

3.8 Wellbeing can increase productivity 21

3.9 More chairs do not mean a higher level of occupancy 22

3.10 ‘Relaxed but serious’ environments are conducive to study 24

3.11 The purpose of a space needs to be clearly defined 26

3.12 Spaces used between lectures support short working tasks 27

3.13 Spaces need to be able to adapt during peak periods 28

3.14 Provision of space at each individual workstation 29
1. INTRODUCTION

Protolib, literally ‘prototyping libraries’, was a 5-month long research project conducted as part of the Futurelib programme between November 2015 and April 2016. Protolib set out to build a detailed and reliable picture of the study needs and behaviour of today’s library users at the University of Cambridge, with a view to developing evidence-based recommendations and models for future space planning in new and existing libraries. Although Cambridge University offered a complex context for this research, given its collegiate system and the fact that it has over 100 libraries – a main University Library, as well as many departmental and college libraries, it was hoped that its findings would be applicable across Cambridge and beyond. The project’s ethnographic research phase incorporated co-design workshops, extensive observation and behavioural mapping in new spaces inside and outside of libraries, and numerous interviews with users and librarians. The subsequent analysis phase saw the translation of the research data into a range of key findings and the creation of a practical toolkit for designing new library spaces.

Project Timeline:

- November to December: co-design workshops, interim findings
- January to March: iterative prototyping, data gathering
- March to April: data analysis, findings and designs
2. METHODOLOGY

Throughout the project a range of research methods were employed in order to gather information on the study routines, preferences and needs Cambridge University’s students and researchers told us they had. Crucially however we also engaged in ethnographic techniques which revealed to us how and where they actually studied or carried out their research. This combination of attitudinal and behavioural research offered us an unrivalled and highly detailed picture of user experience.

2.1 Co-design workshops and LEGO® Serious Play®

In order to derive a clear picture of current user needs and expectations the project began with a series of workshops: two small co-design workshops using card sorting, affinity mapping and other methods, and one large workshop incorporating 7 facilitated groups using LEGO® Serious Play® (a methodology based around the theory of constructionism – you learn as you build). The workshops saw students and researchers (some of whom did not use libraries) detail what they thought constituted their ideal study space, their study likes and dislikes, and also what they considered to be the value of library staff in library spaces. Stated preferences were highly individual, one person’s ‘ideal study space’ was another person’s idea of ‘study space hell’. However, a range of themes emerged as key common elements of study spaces. The workshops also revealed reading, writing, group work, and analysis to be the principal activities in which students and researchers were engaged in spaces inside and outside of libraries.
Workshop findings

A range of interim findings were derived from the needs expressed in these initial workshops:

1. Libraries help users to get work done

Many people claimed that the academic gravitas of libraries inspired them to work, while others said that the social pressure of being around others who are working provided them with a personal obligation to do the same. People also liked the convenience of relevant resources being situated nearby, as well as libraries providing an opportunity to separate their home and work lives. Whatever the reason, many people seem to use libraries as a way to guarantee that they will make progress and achieve something.

2. Different preferences/activities

Workspace preferences are a very personal thing, and many people consider others to be ‘annoying’ when they don’t conform to their ideal individual workspace conditions. Space preferences seem to vary according to the activity people are engaged in. Very few people seem to do the same activity all day every day, so a range of alternative environments need to be provided. Offering spaces for particular activities, rather than spaces where several different activities happen at once, could help to create more distinct and optimal environments.

3. Maintaining and supporting wellbeing

All user groups are keen to maintain their personal wellbeing, especially when they are working for sustained periods of time. They would like library spaces to support this by providing:

- easy access to tea & coffee and the ability to drink or eat in or near workspaces
- spaces to take naps and breaks
- comfortable furniture to prevent aches and pains
- natural materials and views of the outside world
- opportunities for social interaction in order to avoid feelings of isolation
- natural light and appropriate artificial lighting

4. More ‘relaxed but serious’ spaces

People want to do serious work but they also want to feel comfortable and ‘at home’. Formal spaces serve a purpose, but spaces that are too rigid make people feel ‘isolated’, ‘gloomy’ or ‘imprisoned’. Need was also expressed for ‘places to escape to’, ‘places to de-focus’, ‘a change of scenery’ and ‘a
change of position’. In particular people wanted ‘relaxed but serious’ spaces, which ‘feel a bit like home’ but with a focused enough atmosphere to get work done. People also requested spaces with cushions, blankets and lamps, and with access to tea & coffee.

5. **Common requirements**

There are some common requirements that users would like to apply to all types of workspace:

- geographic convenience
- proximity to resources
- access to food & drink nearby
- access to break-out spaces
- cycle parking
- positive signage (things you can do instead of things you can’t)
- self-issue and return, and other DIY services
- safety & predictability
- ergonomic furniture and workstations

These interim findings fed into a concep ting stage, in which it was decided that the new prototype spaces we would go on to create would each be designed as the perfect space for a different type of activity. These prototypes would explore the perfect reading space, the perfect writing space, and so on. This approach responded to the recognition that it is not possible to create a single perfect workspace for all people and all activities.

(Below: members of the Protolib project team discuss the workshop findings)
2.2 Iterative prototyping and ethnographic approaches

Two reading rooms were identified within the University Library in which we could create and explore the ‘perfect reading’ and ‘perfect writing’ concepts: the South and North Reading Rooms respectively. The basement of the Law Faculty was selected to explore the ‘perfect flexible’ space and the social area on the ground floor of the English Faculty the ‘perfect break space’. Plans to explore further prototypes at the Betty & Gordon Moore Library and Churchill College Library as the ‘perfect group work’ and ‘perfect analysis’ spaces were shelved due to furniture constraints and timescales; however a number of students working at these libraries were interviewed as part of the project. Staff at the brand new Engineering Department Library used a range of ethnographic techniques to gather data that also proved invaluable at the analysis stage.

A week of ‘baselining’ took place in the South and North Reading Rooms to establish how they were being used before we altered them. This involved closely observing and noting user activities and occupancy. A range of furniture and furnishings bought cheaply furnished a ‘new look’ South Reading Room (pictured above), while under-used small circular tables were replaced with longer study desks in the North Reading Room. The remainder of the new purchases fitted out the Law Faculty basement flexible space, before they were employed again to form the English Faculty break space.
Consistent and intensive ethnographic observation and behavioural mapping was a key component of the prototype research activity. The South and North Reading Rooms received the most attention and observations took place in these rooms twice a day for almost 3 months.

Observers recorded, in great detail, the following aspects:

- Where are users sitting?
- What are they doing?
- What devices are they using?
- Are they moving between print and electronic materials?
- What do they have with them?
- What furniture and facilities are they using in the room (desks, tables, lamps, blankets, cushions, plug sockets etc.)?
- Does the room reach capacity/does anyone come in and leave due to perceived full capacity?
- Are users eating and/or drinking?
- Is the space silent or is whispering, talking, or conversation taking place?
- How long do users stay in the space?

Users of the spaces were assigned letters on each behavioural map and a narrative log of their activities was recorded for an hour at a time. Observers were asked to pay careful attention to whether the elements they were recording were objective or subjective. They were encouraged to record objective observations in the main body of the log and to collect subjective assertions in a separate section at the end.

In addition to these intensive observation and mapping activities, a graffiti wall was installed in each prototype space. Users were encouraged to share what they liked or disliked about a space, the activity they had been engaged in, and what they would change about the space to improve it. Comment cards and short paper surveys were made available to be filled in and posted in a feedback box. Exit interviews were also regularly conducted with users of the spaces to gather instant feedback on how they felt about the space they had just been working in. By employing this variety of methods we were able to gather an impressive amount of data on both user need and behaviour in these spaces.
(Opposite: behavioural map of the South Reading Room drawn by Naomi Woodburn)

In the closely observed South and North Reading Rooms we took an iterative prototyping approach. This involved changing the layout and content of the rooms at intervals in order to record user reactions to the changes, including if there were differences in room occupancy as a result. New additions to the rooms included: plants, more lamps, more plug sockets, and a welcome mat.

The furniture layouts in the Law and English spaces were also regularly revised and user reactions recorded. Many interviews were conducted in situ in these spaces, as users were more willing to be disturbed in these less intense environments.

### 2.3 Expert interviews

Protolib’s original brief incorporated an examination of library staff expertise in library spaces. At the project’s earliest stages we discussed if we could find out:

- Where libraries and library staff add the most value?
- What high-value services already exist and what spaces do they require?
- What expertise is needed in new types of library space?
- How can we promote high-value services intuitively?

As the project progressed we realised that it was going to be difficult if not impossible to answer these questions for a number of reasons. The iterative prototyping and ethnography we had decided
to commit to was going to be too time-consuming and resource-intensive to allow for detailed parallel exploration of these questions. Also we realised that the availability of staff expertise and support in library spaces and its type and visibility, was actually a very different research project to how users experience and behave in library spaces. We considered staffing one of the prototypes in order to discover what sort of expertise was sought by its users, but as none of the spaces had been staffed previously we were not convinced that creating a library staff enquiry point for a temporary period where it was neither expected, nor possibly even required, would offer an accurate reflection of actual need. Rather than abandoning this aspect of the project entirely, we elected to conduct a number of in-depth interviews with librarians to elicit expert opinion on how library staff expertise is currently utilised within library spaces, and the types of support that are requested. A total of 12 senior library staff were interviewed: 6 from departmental libraries; 3 from college libraries; and 3 from the main University Library.

2.4 Data analysis

While observations and interviews were still taking place in our prototype spaces, we started to organise the data we had gathered. This involved the meticulous coding of all the observation logs, behavioural maps, interviews, and graffiti wall comments. Taking over a small office with long white walls, quickly dubbed ‘The Protolib Bunker’, we started the slow process of transferring all of the data on to the room’s walls on coloured sticky notes. The different colours denoted whether the data on the sticky note was a statistic, a user quote, a specific observed activity, or an assertion based on the information gathered. (Below: David Marshall and Jenny Willatt in the Protolib bunker)
Sticky notes were used in a number of creative ways, as data spreadsheets and floorplans of buildings, however most were sorted by a process known as affinity mapping which essentially involves theming and categorising your data. By physically laying out the data in this way we could start to see patterns and make connections and, crucially, derive findings from our huge dataset.

2.5 Statistical overview

Research methods:

- Observations: 317
- Exit interviews: 127
- Touchstone tours (user led tours of library spaces under study): 14
- In-depth expert interviews: 12
- LEGO Serious Play facilitated sessions: 7
- Co-design workshops: 2

Feedback received:

- Graffiti wall comments: 377
- Comment cards: 287
- Paper surveys: 46

People:

- Workshop participants (students, researchers, postdocs): 75
- Library staff volunteers (conducting observations and exit interviews): 51
- Project Team (project kick-off and concepting stage): 18
- Futurelib staff working solely on project: 1.5 FTE
- Modern Human staff working solely on project: 2 FTE
3. FINDINGS

The key findings of the research phase of Protolib are outlined here. These range from the overarching themes and ideas that were used as a basis for design, to more specific recommendations relating to the provision of library spaces.

3.1 People choose their working environment based on 3 factors

One of the most significant overarching findings of the ethnographic research conducted as part of Protolib was that students and researchers choose a working environment based on the following three motivating factors:

1. Their working activity
2. The intended length of their visit
3. How they feel at the time

1. Working activity: People will usually have a primary working activity, which to an extent dictates their working day. They will choose their working environment based on this primary activity.

Examples: a researcher setting out for the day knowing that they will spend most of it looking through primary source material and taking notes; a student with an essay due the next day, who knows that their primary activity that day will be writing and editing their essay on a laptop.

2. Intended length of visit: Typically people will know in advance how long they plan to spend in a library, hub or other work setting. A number of factors can influence their intended length of stay, including the expected duration of their task, their existing timetable, and other commitments.

3. How they feel: how people feel, and their current state of wellbeing also has an impact on their choice of working environment.

The three motivating factors outlined above have been seen to directly inform a person’s decision as to where they work that day. If any of the factors outlined above change, the individual’s choice of working space is likely to alter accordingly.
3.2 The ‘intensity gradient’

A significant conclusion of the research was that individual environments can be defined and described by their level of intensity. This is of particular importance in relation to working spaces. We found describing and defining spaces in terms of an ‘intensity gradient’ to be constructive. This gradient of observed working intensity in different spaces became an important part of the project’s discourse and fed into concrete suggestions for design. This idea of higher and lower intensity in study environments can be applied across disciplines and is not limited by a focus on specific working activity.

The defining characteristics of different intensity environments have been found to be as follows:

**Low intensity environment**

- Relaxed atmosphere, but still conducive to work rather than breaks.
- Sofas and armchairs, with no traditional desks or chairs
- The presence of additional soft furnishings
- An actively welcoming aesthetic feel
- Quiet (i.e. an acceptable level of whispering but a low level of working noise)

![Image](image.png)

**Medium intensity environment**

- A maximum occupancy of around 40 people
- Presence of humanising features
- Room for each individual working in the space to spread out. Provision for people working with a lot of different materials and devices at once
• The presence of traditional desks and chairs
• Noise levels at a reasonably low level (i.e. the industrious noise of typing and other activity)

High intensity environment
• Low transience (i.e. a lower level of movement through the space, longer stays in the space)
• A silent, or close to silent atmosphere
• The presence of traditional and formal desks and chairs
• Usually a large, open plan area
• Low levels of individual space
• A high level of exposure to other users of the space
• No humanising features
Our observations showed that the acceptable level of transience in a space is key in defining its intensity. The research has shown that lower intensity environments can accept a higher degree of transience. Focused high and medium intensity environments are used by people for long periods of time who would potentially be disturbed by movement in and out of the space. This would in turn detract from the intensity. The prototype medium intensity space had an average ‘long stay’ of 4 to 9 hours, whereas people spent on average a ‘short stay’ of 30 minutes to 2 hours in the prototype low intensity space.

User feedback gathered throughout the project reinforced this finding:

- “I’m using this space as a break from more intensive work.” (History graduate student)

- “This space provides a change of focus from the Library, and a new perspective when needed.” (English undergraduate student)

- “Having space designed to be formal study space, say in libraries, can be too intense. In exam term especially - too much. You need informal spaces to work, it’s essential, formal spaces can be really stressful. In exam term I tend to work at the Marshall Library to avoid other people from Law because that’s stressful too. When I work in the Squire Library I tend to end up focusing on other Law students.” (Law undergraduate student)
3.3 The hierarchy of working activities

The working day of a student or researcher is made up of a range of working activities. Although the specific tasks and behaviours will be different for each person, observation and interviews with users have shown that most academic work involves a hierarchy of primary, secondary and tertiary activities. These have been seen to directly affect where and how people choose to work.

Primary activity
Makes up the largest part of an individual’s working day (in terms of time spent on each activity).

- writing an essay or dissertation
- revising with notes
- working through example papers
- producing a technical report

Secondary activity
Supports the primary activity, and almost by definition requires less time to complete.

- reading a chapter from a book or an article from a journal
- discussing work with fellow students
- looking at existing law precedents

Tertiary activity
Not always directly related to the work undertaken by an individual, but nevertheless supports their working life and is an important part of their day.

- editing diaries and calendars
- communicating with supervisors and colleagues via email

People choose different working environments depending on the level of their current activity in the hierarchy. Most people require a less intense environment to complete their secondary working activity, whereas their primary activity is very likely to be conducted in a medium to high intensity environment. This relates to the fact that low intensity spaces are transitory and short stay, whereas higher intensity spaces are longer stay, and also have more suitable surface provision (i.e. the amount of desk surface area to an individual) for working with a variety of materials at once. Over half of the people observed in the prototype medium intensity environment were using multiple devices and materials. This was almost double the amount of work conducted with multiple media observed in the prototype low intensity environment.
A model showing how different types of activities have been observed to take place in different intensity environments and how this related to length of stay:

Our research has shown that providing a range of spaces is essential. In relation to the hierarchy of working activity this means that if conducted in a lower intensity environment, the secondary activity can provide a mental ‘break’ from the primary activity. When asked why they had chosen to work in the prototype low intensity environment people often responded along these lines:

- “I’m using it as a break from more intensive work.” (Cambridge alumnus)

Importantly the secondary activity is still academic work and therefore must be treated as such and provided for as carefully as the primary activity. A comment about the prototype low intensity environment which supports this idea was:

- “I wouldn’t take a break here, I want to work here. The Tea Room is for breaks.” (Geography undergraduate student)

This theme has emerged gradually but convincingly throughout the research. Observations and feedback have shown that providing low intensity spaces does not mean they will be used for breaks and recreation. If suitably designed and well placed within a network of spaces, relaxed environments (with sofas and soft furnishings) can be serious workspaces and will add to the productivity and endurance of the people using them, rather than detract from it.
3.4 Providing a variety of environments is essential

An individual may use a variety of different environments within a single visit to a library. The ability to move between different types of spaces has a direct impact on an individual’s endurance and productivity. Interviews with users during the project regularly elicited responses related to this theme:

- “I decide where to work based on the task and how stressed I am.” (English graduate student)
- “I move around all the time. I also work in cafes and my college library. If I’m in the same space for too long I lose concentration.” (Law undergraduate student)

Changes in aesthetic across different environments are also important. Providing a variety of different styles means that people can diversify their working days, and are therefore more likely to spend longer in a particular library, building or hub.

- “I like the view out of the window to the courtyard.” (Psychology undergraduate student)
- “I love the aesthetic of the white sofas.” (MML graduate student)

(Below: Students ‘colouring in’ as a break from studying in our English Faculty prototype space)
Different types of working activity require different working environments, with varying levels of intensity and also specific types of workstation and surface provision. Examples of the impact of working activity on an individual’s choice of working environment: an academic primarily working from a laptop, who then needs to read a chapter from a book, moving from a medium to a low intensity environment to do so; an English student reading a novel in a low intensity space before moving to a high intensity space to write an essay on it.

Supporting comments from users on the importance of different working environments:

• “I had been in the UL [University Library] all morning and needed a change of scene, somewhere comfy to do data analysis.” (Psychology graduate student)

• “Please don’t change this space, I love it! I don’t like sitting at a desk as it makes me fall asleep. It also stops me from going on the internet as I don’t use my laptop in there.” (Cambridge alumnus)

• “It’s important to have a room to ‘switch gears’. If the body is comfortable it allows the mind to work.” (English graduate student)

(Below: Protolib’s South Reading Room prototype space in the main University Library was identified as an invaluable ‘low intensity’ environment)
3.5 Location and context are important indicators of space use

The importance of the proximity to other activities and events in the working life of a student or researcher is a factor that should be considered when designing library spaces. Study and break space provision must be based on whether the environment will be seen and used as a ‘convenience’ or ‘destination’ space.

This is supported by previous research conducted by Cambridge University Library including the ‘hubs and halos’ model (see later in this document) and the ‘student triangle’. This geographic triangle represents the area in which students were found to exist – between their college, department and preferred supermarket. Anything outside of this triangle was deemed to be too far away and inconvenient as a result.

- Convenience spaces are those close to activities such as lectures and supervisions. Durations of stay in these environments tend to be relatively short – around 1 to 2 hours e.g. the Law Faculty prototype (pictured below), which was predominantly used between lectures during Protolib.

- Destination spaces are those which users travel to with the specific and primary intention of using that particular space and its resources. Durations of stay in these spaces tend to be much longer – as much as 7 to 9 hours or longer e.g. the University Library’s main Reading Room, or departmental libraries such as the English Faculty Library.
3.6 Provision of well thought out and functional break spaces

Providing break spaces in or close to a network of working spaces is important. Being able to take breaks near to where they are working means that people will stay in a library or hub for longer. This in turn means that their endurance and productivity will be raised.

- “Libraries should include break spaces like this in combination with conventional (silent/calm) spaces.” (English undergraduate student)

- “[The space] provides a change of focus from the Library, and a new perspective when needed.” (Divinity graduate student)

- “This table here usually has a little puzzle on it. It’s a nice touch to sort of just have something to take your mind off work. I also come here to read the magazines.” (Engineering undergraduate student)

Throughout the project students have often been observed studying in spaces designed and intended for breaks and social interaction. Interviews with users of the prototype spaces have supported this. It is therefore important that break spaces are designed with sufficient functionality to support study and do not consist entirely of furniture and fixtures considered to support break activity (e.g. sofas).

- “I usually work in the Library all day so this space gives me the opportunity to leave it, but still be able to do stuff.” (English undergraduate student)

The proximity of food and drink to working spaces is a very important consideration for design. Without readily available refreshments people will be forced to move elsewhere for these provisions. Having to leave the library or hub for this reason is likely to have a negative effect on their productivity.

- “I need coffee to keep working, which is why I use this space.” (Law undergraduate student)

- “The space is convenient, and sitting at tables and couches is comfortable. It’s good if you don’t like the quiet of the Library and if you want to drink tea while working.” (Law undergraduate student)
3.7 People want personal control over their working environment

Control over the environment they are working in is important for an individual, not only to increase personal satisfaction in and with the space, but also so that they can optimise their individual workstation, which is in effect their ‘micro environment’ within the wider space.

The need for personal control over an environment is also directly linked to the length of a person’s visit. It is therefore very important in the medium and high intensity, long-stay environments, but not as important in break spaces, or spaces used as buffers between lectures and other activities. A student interviewed during a short visit to the prototype environment in the Law Faculty building (which was primarily used by people to make use of free time between lectures) had this to say:

• “It seems like a lot of effort to move the furniture. I don’t feel strongly enough to do anything about it.” (Law undergraduate student)

Interestingly, just having the sense of control over an environment can be just as valuable as acting on that control. Feedback from users showed that adding extra plug sockets, lamps and blankets to the prototype spaces gave a sense of ownership and control. However, observations conducted in parallel to this feedback showed that the requested items were not always being heavily used.

(Below: the North Reading Room prototype space in the main University Library where extra plug sockets and lamps were actively requested but not always used)
Small, inexpensive and easy to install features can increase this sense of control, and also increase actual control over working environments. Adjustable furniture, task lamps, earplugs and blankets can all be installed in existing working environments to optimise their potential, and will help to increase user satisfaction, endurance, productivity and length of stay. It is also important that the design of working environments takes into account differences between individuals.

- “The blankets are great. I love those. They’re being used in the North Reading Room too!” (English undergraduate student)
- “I feel like I can have my own space.” (History graduate student)

3.8 Wellbeing can increase productivity

The fact that the careful design of environments can support individual wellbeing and improve peoples’ productivity became a strong emergent theme of our research. As we have already explored, individuals choose a working environment based on how they feel, as well as the task they need to complete and their intended length of stay.

Humanising features such as plants, flower arrangements and blankets can have the effect of significantly improving the quality of a working environment, while also lowering its intensity.

Our research also shows that people with a high level of emotional wellbeing can be productive in low, medium and high intensity spaces. Meanwhile, people with a low level of wellbeing are more likely to be productive in the less austere medium to low intensity environments, depending on their task.

Users of the prototype low intensity environment commented:

- “I have written my entire introduction in the South Reading Room, which is real academic work, because it’s such a relaxed and comfortable environment. I found it much easier to do than if I was sitting at a desk with like a neon light, focused intently on the work.” (English graduate student)
- “This space supports my needs because I find Cambridge too intense and stressful” (History undergraduate student)
A user of the prototype break space commented:

“I used to have a mental block in more traditional and serious spaces. I can start work instantly in here.”

(English graduate student)

(Above: Studying take place in the English Faculty prototype break space.)

3.9 More chairs do not mean a higher level of occupancy

A surprising finding was that increasing the number of chairs and workstations (individual study spaces) in a working environment does not necessarily increase the occupancy of the space, in fact the opposite can be true.

This was particularly apparent from our regular modification of the layout of the North Reading Room prototype space. Before Protolib the room contained 31 chairs. Over the initial observation period before any changes were made to the room or its furniture, the average occupancy was just 7 people, while the highest occupancy was 11 people. As we created new prototype layouts, first 7, and then another 4, chairs were removed. On each occasion when we removed chairs the occupancy of the room increased as a result.

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In the final weeks of observation the room was occasionally at full capacity, with an average of 15 users sat at the room’s 20 workstations. In this way, by removing more than a third of the chairs we had doubled the average occupancy of the space.

Chart showing that removing chairs increased occupancy, eventually resulting in maximum capacity:

It was also found that perceived occupancy and territory had a strong effect on whether or not people would use a workstation. The room’s original 31 chairs/workstations had been placed too close to each other. By removing chairs we in effect increased the surface and space provision for each potential user making the space a more attractive place to study.
• **Perceived occupancy:** whether a user feels like there is room for them in a space, regardless of how many workstations are actually available. Initially we observed many people enter the space and leave again despite the fact that there were plenty of chairs to sit in.

• **Study territory:** to what extent an individual feels comfortable sitting next to, or across from someone else in the space, based on perceived boundaries.

The increased occupancy was not only due to removing chairs and increasing workstation space. We also discovered that blocking sightlines between individuals optimised occupancy. This was seen in iterations of the North Reading Room prototype in which task lamps and plants were added to tables. We observed that people appeared to be more comfortable entering the space and setting up their workstation opposite someone who was unfamiliar to them.

Spaces designed for optimum capacity should therefore take personal space requirements into consideration. This finding is of crucial importance to the planning of layouts and furniture installations for working environments.

### 3.10 ‘Relaxed but serious’ environments are conducive to study

As mentioned earlier in the report students and researchers in the co-design workshops told us that they needed ‘relaxed but serious’ study environments. People talked about wanting somewhere to work that felt like home.

Data gathered from interviews and observations during the prototyping stage of the project validated this idea. Users of both the medium and low intensity prototype environments appreciated the more relaxed atmosphere created by the addition of soft furnishings, plants and other humanising features.

Responses to the question ‘What do you like about this space?’ on the graffiti walls from two of our more ‘relaxed’ environments:

- “So much less oppressive than the rest of the Library! Very calming.”
- “Made to feel more homely, therefore you feel more comfortable to work.”
- “Not isolating, but a relaxed, quiet place.”
- “Like working in a coffee shop, but quieter and without coffee.”
- “Like a living room but shared with other people.”
Incorporating sofas and cushions in environments will not automatically make people lazy, or signal ‘social interaction’ - encouraging breaks and conversation. If suitably defined, and placed within an appropriate context, these lower intensity environments will be used for working activities. Students and academics of all levels and disciplines were observed working in the prototype low intensity environment. (Above: Students working in the ‘relaxed’ South Reading Room)

Users responded to another graffiti wall question ‘What kind of work do you do here?’ in our more relaxed environments as follows:

- “Writing an essay”
- “Preliminary reading, browsing”
- “Great place for editing”
- “Good for taking notes”
- “Data analysis”

The need for the provision of these types of working environment relates to the intensity gradient and the hierarchy of activities. People are more likely to use a relaxed working space to complete secondary and tertiary activities, and when they require a less intense working environment. Not all work spaces should be relaxed and comfortable, as many people perform well in higher intensity environments, which have a more industrious and austere feel.
3.11 The purpose of a space needs to be clearly defined

During the project we found that in the library spaces we observed silence was the lowest common denominator. In other words if a space is not clearly defined for purpose, and if acceptable noise levels are not marked in some way, it will default to being silent. Where spaces have been ambiguous in terms of permitted noise levels and activities, people using them were unsure as to what was acceptable behaviour.

A group of users of one of the prototype environments had this to say:

“You need to establish what the space is, if someone seems to be working here you don’t want to sit down and start chatting as you feel you’re interfering.” “If it were marketed or signposted as a space people could talk in this would be better. You wouldn’t mind chatting when people were working in the space.” (Divinity graduate student and English undergraduate student)

The nature and intensity of an environment can be defined by its users. If the workspace is not too large it is possible for a group of people using the environment to take a lead from each other, or talk to each other about its purpose and characteristics, and to agree on the desired intensity and noise level of the space. Throughout the project we have observed that people tend to be good citizens of workspaces; they are keen to work alongside side others and have a good working relationship with them, even if sometimes this relationship is unspoken.

(Below: Two different suggested layouts in the flexible prototype space in which users were encouraged to make what they wanted of the environment)
3.12 Spaces used between lectures support short working tasks

Our research showed that spaces located in close proximity to timetabled events such as lectures or supervisions were often used to conduct short, less intense working tasks. The convenient location of these spaces means that people can continue to work during gaps in their timetables. In this way, between-lecture spaces help to increase productivity by creating valuable opportunities to work during periods of time that might otherwise be wasted.

The following activities were taking place in the Law Faculty prototype space that was primarily used by students between lectures:

- group work
- supervision preparation
- essay writing
- administrative tasks and emails

Due to the nature of work conducted in these spaces they do not need to be silent, or even quiet. Many students interviewed in the Law Faculty space mentioned that they found the background chatter and noise level to be conducive to their working activity:

- “I like to work where there is background noise.” (MML undergraduate student)
- “I feel like I can concentrate more with some background noise – there is research to prove this.” (Law graduate student)
- “I like working when people are walking around and relaxed.” (Law undergraduate student)

The provision of plug sockets or charging stations is essential in between-lecture spaces, due to the fact that students need to recharge their laptops between lectures. One student commented:

- “You need plug points in this space, as lecture theatres don’t have them.” (Law undergraduate student)

People are likely to use these environments to take breaks, as well as to work. This mix of activity was often observed in the Law Faculty space. It is therefore very important that the furniture provided in between-lecture spaces supports both working activities, and breaks. Providing access to refreshments is also necessary.
3.13 Spaces need to be able to adapt during peak periods

At different points throughout the year library services and spaces need to support different user behaviours and needs. Spaces will also need to support different levels of occupancy. It is therefore important that the potential occupancy of a space can be increased temporarily to meet changes in demand. For example: the addition of extra chairs and furniture in order to provide more individual workstations during peak revision periods.

The amount of people working with multiple devices and materials is likely to drop substantially during peak periods. During exam revision many students will be revising either from printed notes or with their laptops, and will not require the same amount of space and surface provision they had when they were using many different materials in order to write an essay. The addition of more workstations to increase potential occupancy and reduction in levels of individual space provision will have the effect of increasing the intensity of a space. A larger number of high intensity environments are likely to be required during exam revision periods. Many students have mentioned that they are more productive in high intensity spaces with an industrious atmosphere when they are revising and working towards deadlines. This means that the increased potential occupancy and intensity can potentially be of benefit to both library staff and the users of their service.

• “I don’t know come exam term whether people are going to appreciate having lost a lot of space that would have been silent study area, which is going to be in short supply with everyone trying to revise. I don’t know whether that’s necessarily going to be ideal, but it might also be that a kind of collusive behaviour occurs where everyone just wants to work quietly in here.” (Engineering undergraduate student)
3.14 Provision of space at each individual workstation

Workstations need to reflect and be appropriate to the intensity of the environment in which they are situated. For example: people who choose to work in a medium intensity environment are more likely to be using multiple resources and devices, and therefore require more surface provision.

(Below: A student uses a large surface area to work with multiple books and electronic devices)

Provision of individual space in the low intensity environment is a slightly more complex issue. Observations and feedback from the prototype low intensity environment show that people value having a ‘personal bubble’ (an uninterrupted space to call their own), and that providing this is an important way of lowering the intensity of an environment. People were seldom observed sitting next to each other on a sofa, and appeared to be more focused and productive when they had an area to themselves with a sofa, coffee table, plugs and personal lamps. The need for a personal bubble has been seen to be inversely proportional to the intensity of the environment, i.e. of paramount importance in a low intensity environment, but likely to detract from the benefits of working in a high intensity environment.
3.15 Group work requires open and closed environments

Observation and user feedback throughout the project have shown that group work requires two different types of working environments: open and closed. Prolonged, formal group work will be more likely to require a closed environment. More casual group work was seen taking place in open study spaces, in areas that had been designed and optimised for breaks, and also in spaces that were used between other activities such as lectures and supervisions.

- “We’re mostly working independently but we like to do that with each other.”
  (Economics undergraduates)

There is a danger too that environments designated for group work are too large and will suffer from becoming more areas where silence is the lowest common denominator.

(Below: Group work in the collaborative space at the new Engineering Library)

We did not gather sufficient evidence during this project to determine whether it is in the remit of libraries to provide group work spaces. However, we would advise that libraries offer spaces that are complementary to nearby spaces and the wider context of their geographical surroundings. Several students interviewed about the value in the idea of the basement of the Betty and Gordon Moore Library becoming a group work space stated that they felt the nearby Maths Cafe and Pavilion buildings already fulfilled this function for them, however this attitude might well vary between
undergraduates and researchers who enjoy different levels of group work space provision. Furthermore it is highly possible that now such a space is available that they may well use it, regardless of the views they expressed to us in interview. It would not be the first time in this project that professed user need (or lack of need) conflicted with actual user behaviour.

During the course of the research groups were often observed working together outside of their own faculty or department buildings and libraries. Students saw the nature of the environment as the most important factor, rather than the proximity to resources, or location in their department or faculty building. One particular user group was identified specific to the Sidgwick site hub. Dubbed ‘Sidgwick Nomads’ these students were sometimes members of nearby colleges and hailing from many different disciplines: Geography, Economics, Medicine, History, German, HSPS, Linguistics, Criminology, MML, and Development Studies. They were united by their mission to seek out alternatives to the library spaces provided by their departments, in particular seeking suitable group work spaces or places to work where strict silence was not enforced.

Comments from the Sidgwick Nomads:

• “The Law Faculty is great, because it’s so big here and there are a variety of spaces.” (Economics undergraduate student)
• “We’re actually trespassing – we’re Geography students but there’s no space there.” “You can’t talk in the Library there, it has to be silent.” (Geography undergraduate students)

3.16 Positive zoning is important in defining spaces

It was apparent throughout the research that signage is rarely the most appropriate or constructive way to define the intended use of a space, whether that is to give direction on acceptable noise levels, or food or drink permissions. A great deal can be done to define an environment without signage, including the positive zoning of areas with different coloured floors and walls, and the use of specific furniture in a space. If signage is required it should be positive, and encourage rather than prohibit behaviour. An example would be introducing a sign worded ‘Group work’ to ensure that other areas of the building remain silent, rather than marking areas intended to be silent with ‘Silence’ signs.
• “I appreciated them putting up notes saying ‘You’re allowed to eat snacks and stuff in here’, because at the start I was sort of like ‘Am I allowed to? Am I not?’ Yeah, having that clarified was good.” (Engineering undergraduate student)

Our research highlighted the need for further investigation into signage, zoning and wayfinding in library environments, as a thorough exploration of this issue was beyond the scope of the Protolib project.

3.17 Workstations offering natural light, plug points, and privacy are the most popular

Heat maps were created from the behavioural mapping data to reveal the most popular workstations in the low and medium intensity prototype environments.

South Reading Room (Low intensity environment):
Here the most popular seats had access to plug points and natural light. People were seen to be comfortable sitting across from one another in the triangle sofa configurations, provided there was some kind of barrier between them.

North Reading Room (Medium intensity environment):
Baseline observations in this room saw most users heading for the seats at the ends of the room. Interestingly when all tables were provided with plug points and lamps, and after sightline blockers (plants) were introduced between individual workstations people were happy to sit in the middle of the room, now that they felt less observed.
FURNITURE FINDINGS

Our research has led us to some specific findings relating to furniture provision:

a) Furniture influences the intensity of the environment
Certain types of chairs, desks and other furniture are especially suited to particular intensity environments. For example, medium to high intensity spaces should be furnished with more ‘traditional’ desk and chair workstations, whereas low intensity working environments work better when they contain armchairs, sofas and other soft furnishings.

b) Context has a direct impact on how furniture will be seen and used
Sofas in the prototype space used primarily between lectures were used for eating, and chatting about work, whereas sofas in the prototype low intensity working environment were used for silent individual study.

c) Sofas and armchairs should provide surfaces to support occasional desk work
During the project users of the prototype environments were regularly seen using the seat of the sofa next to them to support laptops, books and other materials, and were also using the wide arms of armchairs for similar purposes. It is therefore vital that low intensity working environments include comfortable seating that can accommodate comfortable use of devices and other materials.
d) A sense of divide between workstations is important, particularly in terms of eye-level ‘sightline blockers’

The different iterations of the prototype medium intensity environment saw task lamps and plants added on tables between individual workstations. The effect this had on the occupancy of the space was indisputable. The highest observed occupancy of the space rose from 13 to 18 people (with 20 potential workstations) when plants were introduced in the middle of the tables. In other environments lamps at eye level were seen to have a similarly positive effect. Sightline blockers and workstation boundaries could also by achieved by installing small shelves at the far end of each desk for books and other items.

e) The size of an individual workstation needs to be considered

People were often observed in the prototype environments using multiple materials and devices. They therefore needed a large individual desk area to comfortably conduct their work.

f) The need for customisable workstations increases with length of stay

Our research suggested that people are more likely to need individual control over their working space the longer they spend there, with the level of investment in a space increasing in line with duration of stay. Therefore installing moveable and adjustable furniture in these ‘longer stay’ environments can really benefit users. Library staff also need to be able to adapt spaces (including furniture and workstations) during periods of high demand and peak occupancy when durations of stay are longer. At these times of year customisable furniture is useful as it can support different activities, e.g. the provision of coffee tables that can temporarily become desks.

g) Furniture in break spaces needs to support both break and working activity

We observed that spaces designed to support break activity and reflection were used by some people for academic study. Break spaces therefore need to include furniture suitable for laptop work and work with books and notes, as well as furniture suited to conversation and relaxation. In the prototype break space at the English Faculty building, users were observed using the desks and chairs provided just as much as or even more than the sofas, and user feedback supported the view that the inclusion of desk height tables was particularly welcome.
h) Furniture should be adjustable, or a range of furniture should be provided

People have different requirements for furniture, which should inform decisions related to desk and chair provision. Height, posture and other factors are different for each individual. Whenever possible adjustable desks and chairs should be provided to cater for this, and if this is not possible a range of furniture should be present. This may seem obvious, but too many working environments are currently only furnished with static chairs and tables, and often with only one type of each. This is especially vital for users with disabilities who are more easily catered to with adjustable furniture.

i) Adequate provision of plug points will increase length of stay

Our observations showed that individuals often had multiple devices with them. People were regularly seen using a tablet and laptop together, and almost everyone used a mobile phone at least once while working (although not to make voice calls). It is therefore vital that sufficient plug points are included in working environments, particularly those of a medium or high intensity where people are likely to stay for long periods. Feedback from all the prototype environments under study emphasised the need for plug points, and the fact that in many environments across the University far too few are currently provided.

j) Temperature level is an important factor, and needs to be customisable

A large amount of feedback was gathered from users of the prototype spaces that related to temperature, and temperature control. If people are intending to spend a long period of time working in an environment they need to feel comfortable with the temperature. Blankets, fans and heaters are an effective way of offering personal control.

k) Furniture should always be tested before purchase

The importance of testing furniture should not be underestimated. It is common to populate study spaces with furniture chosen purely on the basis of aesthetics or architectural design, without proper attention to functionality and with little or no pre-purchase testing with potential users. This leads to the purchase and installation of: poorly functioning desks of inappropriate sizes; study spaces filled with underused tables (each surrounded with four chairs but only ever used by one person due to their size and location); and reading rooms full of chairs which are identical and non-adjustable, and therefore only comfortable for, at best, some of the people using them. Any new furniture should also be usability tested by users with disabilities.
LIBRARY STAFF EXPERTISE IN LIBRARY SPACES

As described earlier, this aspect of the project was explored via in-depth interviews with senior library staff from a variety of Cambridge libraries. The following themes emerged from the majority, although not all, of the interviews:

1. Library staff visibility, friendliness and approachability in library spaces is essential
   - “The key thing about library staff in library spaces is that they are friendly and approachable enough to answer questions. We know that people won’t approach us to engage with our expertise because they are afraid.”
   - “There’s lot to be said for visibility, for glass and an open door.”
   - “I’m very much encouraging the staff there to be the friendliest people on earth.”

2. Actively building engagement and relationships with users, and thereby shaping positive perceptions of librarians is the best route to users making full use of library staff expertise (and library space can be incidental to that)
   - “The relationship is to do with all the other things we do than the space. Focusing and tailoring our service to user needs and making sure we continue to meet user needs.”
   - “We’re constantly looking to try to be innovative and engaging them, and finding out how we can help. That ‘asking if we can help’ is really valued.”

3. Relationships with users are built most effectively in tearooms, teaching sessions and library staff-hosted break sessions with refreshments (especially in exam term), in spaces beyond the library where students work, and by word-of-mouth recommendations between users
   - “Our ‘Tea at 3’ with our users (now so successful that it’s in the foyer rather than my office) is about conversations, to build confidence and relationships. To ask questions and not worry about whether the question is silly. It’s OK not to know.”
   - “Whatever tea facilities are in the building is where we need to be.”
   - “I encourage academic related members of the team to spend times outside of the library working where our users work - this makes them approachable and leads by example showing you can embrace our service wherever you are.”

4. Some library desks and spaces act as barriers and detract from the library expertise offered, and this can reinforce contrary or unhelpful preconceptions
   - “Our library space actually inhibits the diffusion of those services that communicate staff support and expertise.”
• “There’s a huge 8-foot counter… they can come behind the counter and talk to us but it’s a barrier… it sets up an old style library counter relationship that no longer exists - a real and perceived barrier. Physically there’s a staff-space mismatch.”
• “The building is so forbidding with its 1930s style. I’m sure there are people who come in and go out without using it.”
• “The space here is a real problem”
• “Physical buildings have personalities, certain messages, which communicate authority, informality, indicate inclusion within a particular community or exclusion, and sometimes these exclusions and inclusions are counter intuitive.”

5. Modified library desks and library desk areas were suggested that offered more visibility to, and interaction with, users

• “I’d design the desk differently now, with a separate ‘staff working’ space and ‘staff interacting with users’ space.”
• “The information desk was previously a huge tall thing that shorter people could barely see over. It was not suitable for accessibility in any way, so specifically we wanted something lower.”
• “We position library staff in a visible place and a thoroughfare… I believe you have to place yourself in people’s line of sight.”

6. User expectations of library assistance can be low, and those who seek it are often surprised at, and very pleased with, the level of expertise and support available

• “I want them to be disappointed when I don’t know something, rather than excited that I actually know something!”
• “The expertise is greater than you expect. Academics assume they know more than us and are not actually picking up on this greater expertise we have.”

7. Users are perceived to be reluctant to seek library staff support, for fear of seeming ignorant

• “I find users are reluctant to ask anything. They worry: ‘I’m going to look a fool’.”
• “They often come to us thinking ‘I’m the only person who doesn’t know how it works’.”

8. The majority of ad hoc enquiries received in library spaces seek IT support, book locations, or other types of basic assistance (however it is important to note that while complex or detailed enquiries are rarely received in the library space, they are received by email or in person by specific senior staff)
• “Students come in here a few times a day, but it’s for IT help rather than library help, like how to update their account, or maybe a problem borrowing a book, or they want to buy something, or they can’t find something on the shelf.”
• “Enquiry-wise the majority of people want really basic stuff such as printing.”
• “Enquiries are mostly to do with routine circulation”

9. Physical paper guides to the type of staff support and services available are now rare, or very much pared down with information provided on Moodle or websites instead

• “The old printed library guide was a contract, now we just have a bookmark instead with basic info.”
• “There used to be a printed library guide on every desk but I didn’t see the point. I’m happy not to have them anymore. It’s all up on Moodle.”

10. Users chiefly regard the library as a study environment equipped with convenient and relevant print and electronic resources, rather than as a place to seek support and expertise

• “Here for all users the space is the service”
• “There are times when it feels as though the space and everything in it is strong and fully-formed, and we just happen to sit in a space beside it. With self-issue and return the Library could almost carry on without us being here.”
• “I’d say that the space is most important to our users, then the materials, and then the staff.”

11. There is no shortage of staff will or enthusiasm within Cambridge libraries to support library users, in any and all aspects of their study lives

• “We will do the utmost to support academics and pretty much do anything for them, same with the students”

Some of these interview themes led us towards design suggestions for ‘expertise points’ (see page 50), but mostly they have re-emphasised to us the requirement for further research into the topic of the promotion of staff expertise and the apparent reluctance of library users to either seek it or expect it, first recorded as part of Futurelib’s ‘WhoHas?’ pilot.
CONTEXT

The University of Cambridge and its libraries represent an almost unique research environment, however we are confident that many of Protolib’s findings are transferable and applicable beyond Cambridge. Nevertheless there are some particular Cambridge-based phenomena that require special attention.

Cambridge University topology – the ‘hubs and halos’ model

The wider context in which an environment exists directly affects its nature. The provision of library working spaces and other environments should always be explored in the context of the network of existing spaces around them. This approach is supported by previous research conducted by Cambridge University Library, specifically the idea of the ‘hubs and halos’ model.

The libraries, departments, faculties and colleges of the University of Cambridge are distributed throughout the city. By observing how students and researchers move between locations it is evident that these locations form 3 key hubs, with each hub containing a concentration of University faculties and other buildings. It is possible to think of the area surrounding a hub as a ‘halo’ that rings it, which also contains University facilities, faculties and colleges. Each halo has a lower concentration of University buildings than the hub it surrounds.

The 3 major hubs are: West Cambridge; Sidgwick; and the City Centre (consisting of the New Museums and Downing sites). The demarcation of what lies inside the hub and its halo (see next page) is not an exact science and is largely based on observational research with students and academics. In the diagram presented here the hubs and halos are as follows:

West Cambridge

- Hub: The Cavendish Laboratory, Electrical Engineering, the Computer Lab, the Hauser forum and the Department of Veterinary Medicine.
- Halo: the Madingley Rise site, Churchill College, the Centre for Mathematical Sciences and the Betty and Gordon Moore Library, Fitzwilliam College, Murray Edwards College and St Edmund’s College.
Sidgwick

- **Hub:** all of the many departments on the Sidgwick site (Classics, Economics, English etc.)
- **Halo:** the main Cambridge University Library building, Robinson College, Selwyn College, Wolfson College, Newnham College, Darwin College, Queens’ College, King’s College, Clare College, Trinity College and St John’s College.

City Centre

- **Hub:** the New Museum site and the Downing site.
- **Halo:** Judge Business School, Department of Engineering, Art & Architecture, Downing College, Pembroke College, Peterhouse, Corpus Christi College, St Catharine’s College, Emmanuel College, Christ’s College, and Sidney Sussex College. Due to their location, St John’s College, Trinity College, Clare College, King’s College, and Queens’ College could be considered to be in the City Centre halo as well as the Sidgwick halo.

In addition to these 3 hubs there is another obvious hub at the Addenbrooke’s Hospital site. Research at this time did not include details on whether Hills Road’s Homerton College and the Faculty of Education form a hub on their own or are a halo of the Addenbrooke’s hub.

### The influence of hubs and halos

An individual’s usage of working environments and libraries at the University is heavily influenced by the location of both their college and their department, and whether these two locations are in the same hub or in separate hubs. An individual will behave very differently based on these factors.

For example, a student whose college and department or faculty are in the same hub is likely to choose work spaces based on activity, intended length of stay and their current state of wellbeing. They will move between department spaces and college spaces at will. However, due to the proximity of the locations they usually use, their tendency to move outside of the hub is lower.

In comparison, a student whose college and department are in separate hubs chooses their working spaces based on its proximity to their current location. For example, a student studying engineering at Churchill College (West Cambridge) is more likely to choose to work in College when they are there already, and only in the Engineering Department (City Centre) when they have lectures.
Providing the right library spaces in the right places

When considering library spaces it is vital to consider the wider context in which they exist. There are two important factors to consider. The first is the expected user base, the second is the balance of types of environment in the surrounding area, in Cambridge’s case - across a hub.

• Expected user base. The expected user base of a hub is key to deciding which kinds of spaces to provide. Knowing whether users are likely to be mostly undergraduates, postdocs, or senior academics should inform decisions as to the types of environments provided. The predominant type or types of work conducted by this user base is also important. For instance, some disciplines are more likely to involve working in a group or team than others and so will value a relatively higher proportion of closed group work environments.

• Balance of environments. Most hubs will contain a number of libraries. It therefore makes sense to ensure that a range of environments is available across these spaces. Specifically they should provide a balance of low, medium and high intensity environments, and a number of open and closed group work spaces. Certain disciplines may have less of a requirement for group work and this needs to be established across a hub. Proportionally there need to be fewer group work environments than low, medium and high intensity working environments, but some should always be provided. The provision of break spaces and between lecture spaces is also important but these tend to be situated outside of libraries.

• Context assessment. What already exists locally? Before planning new library spaces it is vital to take stock of existing environments in and around the planned location. Understanding where the expected user base currently works and the facilities they currently have available to them allows the creation of appropriate new environments that address unmet user needs. It also prevents the replication and over-provision of existing types of spaces. Libraries should not try to compete with existing facilities in the hub or area, and should instead focus on optimising their own unique selling points.

Viewing Cambridge as a network of linked and interrelated library and non-library spaces, and planning suitable varieties and types of spaces for different activities accordingly would not only make sense economically, but also improve the overall experience of Cambridge’s students, researchers and academics.
DESIGN SUGGESTIONS

Low intensity environments

Sofas and armchairs
The provision of living room style furniture such as sofas and armchairs is essential when creating low intensity working environments. These soft furnishings give people the comfort they need when looking for an opportunity to recharge, and provide an important change from medium or high intensity spaces.

A flat surface for each workstation/seat
People conduct a range of activities in low intensity spaces, some of which require a flat surface (for example working with a laptop or taking handwritten notes). Flat surfaces should therefore be provided for all seats in the space. As a minimum these flat surfaces could take the form of wide, flat arm rests on sofas, which could be used for working with books, notepads or laptops. As an optimum, they would take the form of high, moveable coffee tables, which could be placed to the side or front of sofas and armchairs.

Atmospheric lights and individual reading lights
It is important to provide atmospheric lighting in low intensity working environments. Standing floor lamps and adjustable tasks lamps help to raise the overall lighting levels in theses spaces, whilst also supporting working activity.

Cushions and blankets
Cushions and blankets increase personal wellbeing by enabling people to adapt the space to their own comfort requirements. Cushions can be used to adapt seats and support posture, or to rest laptops, books and other materials on. Blankets can increase individual warmth and comfort when people are feeling cold, tired, stressed or unwell. (You will wish to explore a regular cleaning routine for blankets should you choose to incorporate them into your spaces)

Personal space
Providing a suitable amount of individual space creates a ‘personal bubble’, which is a key characteristic of low intensity spaces. People make use of this additional personal space to think, reflect, and recharge.
Layouts should maximise access to natural light, and views of the outside world

Providing access to these features will lower the intensity of the space. Furniture layouts in low intensity spaces should therefore maximise the number of seats with these characteristics.

• Single sofa configuration (Low intensity environment)
This single sofa configuration could be used to create small low intensity areas. It could be placed in corridors, or in small areas between book stacks.

• Three sofa configuration (Low intensity environment)
Our research showed that face-to-face and back-to-back layouts were preferred by users to layouts that created a feeling of being overlooked. People are happy to sit on sofas opposite others, as long as there is a physical boundary between them. This could take the form of a rug, coffee table, or plant.
• 4 x 3 sofa configuration (Low intensity environment)

Medium intensity environments

Individual task lamps and plugs sockets

Due to length of stay in medium intensity environments, each desk space should be provided with its own individual task lamp and plug sockets. Task lamps help people to work for longer, as it means that they can adapt their workspace to support different tasks, varying light conditions and personal preferences. People working for long periods of time may need to charge multiple devices throughout the day, so at least 2 plug sockets per person should be provided, but preferably 3 or 4.
Desks and chairs with a generous amount of space for each person

Medium intensity spaces should be furnished with traditional desks and chairs. Each individual desk space should have a surface depth of at least 60cm and a surface width of at least 120cm, in order to support the use of multiple materials and devices. This increased amount of desk space per person means that the room will be less densely occupied, a defining factor in medium intensity environments.

Humanising features

One of the key differences between a high and medium intensity space is the existence of humanising features such as plants, which make the space feel more personal and less oppressive. The presence of plants on tables and between individual workstations also contributes to medium intensity by blocking sightlines and helping to reduce the sense of exposure users feel in the space.

Generous spacing between desks

The amount of space provided is extremely important in medium intensity environments. Generous spacing should be allocated between furniture blocks, to allow people to move freely around the space, and to feel comfortable doing so. This allows for a higher level of transience than in the more densely populated high intensity environments.

• Minimum viable layout (Medium intensity environment)

This furniture pattern forms the minimum viable medium intensity space. It could be used on its own, or around the perimeter of a larger space against a wall or window.
• 4-person tables (Medium intensity environment)

Tables in a medium intensity environment should accommodate no more than 4 people, in order to maintain the intensity level of the space. Extra chairs could be added during peak periods, to raise the potential capacity of the space, and to increase the intensity.

• Maximum viable layout (Medium intensity environment)

Each medium intensity environment can contain furniture blocks of between 2 and 4 people, with up to 20 people visible to each other at any one time. Layouts consisting of more than 20 people should be divided by a visual buffer (e.g. book shelves or hanging signs), which lowers the degree of exposure by reducing the number of people visible to users of each section of the space to a maximum of 20. Without this type of buffer the intensity of the space would be likely to increase.
High intensity environments

Traditional furniture with a reduced amount of desk space per person

High intensity environments should be furnished with traditional tables and chairs, laid out in such a way as to reduce the amount of desk space per person. Having individual workstations located close to each other creates a disciplined feel, as people sense their exposure to other users of the space, and are aware that their activity may be being monitored. Sightlines should also be kept open in these spaces to further increase exposure. These factors will prompt users to focus on their working task. Desks in high intensity spaces should be longer, and positioned more closely together than those in medium intensity spaces. This again helps to create a more densely occupied space, increasing the intensity of the environment.

• High intensity environment

Reduced spaces between individuals in a large ‘open plan’ area.

![Diagram of reduced spaces between individuals in an open plan area.](image-url)
Break environments

Furniture should support both work and break activities

Our research has shown that people use spaces intended for breaks for a wide range of activities. Some people take 10 minutes to sit on a sofa, have a drink and a chat with a friend, or read the newspaper. Others use break spaces to support more productive breaks from a library, spending 20-30 minutes to read a chapter from a book or to complete administrative tasks.

High tables should be provided

It was found that high tables are particularly popular for various activities, including eating, playing games and doing laptop work. It is therefore very important that they are provided in break spaces, and that the environment is not entirely made up of more comfortable furniture such as sofas. See diagram below.
Expertise points

An expertise point is a physical place where users can approach staff to ask about library services. The design for these will differ depending on the services it needs to support, and the expertise offered by staff. The physical configuration of the individual expertise point needs to reflect its purpose, as well as supporting the intended service.

Expertise points are staffed spaces, with library staff either seated or standing at a desk waiting to provide advice, expertise and assistance. They should be positioned in highly visible places and identified with clear signage that also advertises the types of services and expertise available. The desk should not be too high, or it will be perceived as a barrier between the staff member and the user. Expertise points can also be situated in glass walled rooms that ensure consultations do not disturb users of the space around them, but which still advertise the availability of staff support.

Some expertise points may be best situated in areas between library spaces (see descriptions of ‘landing zones’ and ‘transition spaces’ on the following page). The increased amount of traffic in these areas will publicise the expertise point, and the informal nature of the space it is located in will encourage people to engage with experts. The higher accepted noise levels in these environments will help people feel comfortable to approach and talk to staff. Expertise points should not be located in medium and high intensity environments.

The provision of sofas beside expertise points will allow the staff member to conduct longer and more complex enquiry interviews alongside the user rather than across the barrier that the desk forms. This will put the user, who we know to be reluctant in seeking advice for fear of looking foolish, at ease and more open to the support of library staff.
Transition zones, landing zones, and boundaries

Transition zones should be used to allow people to circulate between distinct types of environment.

The key role of transition zones (areas between other distinct types of environment) is to preserve the individual qualities of different space types by acting as a buffer between them. Providing a transition zone reduces the disruption caused by movement between different environments, and the zone acts as a distinct physical cue that prepares people for a change in behaviour appropriate to the new space. Examples of transition zones include foyers, corridors and landing zones (see definition below).
A single transition zone can serve multiple types of environment at once

A single transition zone can be shared between multiple types of space. This will result in an increased amount of traffic in the transition zone. When this situation arises it may be more appropriate to create a landing zone. Landing zones are larger transition zones in which people can meet, gather or organise their belongings, before entering or leaving an environment.

High intensity spaces should be accessed through layered transition zones

Due to the strict silence required in high intensity spaces, they should be distanced from busier or noisier spaces by the use of multiple transition zones. This will decrease the amount of disruption the high intensity spaces experience, and help to preserve a focused, disciplined atmosphere.

Complimentary relationships between spaces

Spaces with different levels of intensity have been seen to be mutually supportive of each other. People need to vary their environment as their tasks change throughout their working day.

The co-location of high, medium and low intensity spaces helps to create a diverse working environment, which supports a wide range of activities and preferences. The ability to shift gears increases the effectiveness of each individual space type, by enabling people to have a change of scenery throughout the working day. This supports personal wellbeing and increases the amount of time people can spend working in a library or hub, which results in a higher degree of productivity.
Location of ‘between lecture spaces’
Between-lecture spaces should be located in close proximity to break spaces and timetabled activities. Many people referred to ‘lost time’ between lectures, due to the inconvenience of having to return to faculties or colleges during short gaps in their timetables.

Between-lectures spaces that are conveniently located play a key role in converting this lost time into productive time. Proximity to break spaces further minimises lost time, as it enables people to work whilst having a coffee or snack.

Boundaries between environments
The necessity for boundaries between different environments will depend both on the nature of the individual environments, and on the relationship between them.

Solid boundaries
Spaces with distinct characteristics, especially with regard to intensity or noise levels, should be separated by solid boundaries. This helps to preserve the specific characteristics of the spaces, which are crucial to their role within the wider environment. In cases where openings in a single solid boundary could disrupt the nature of a neighbouring space, transition zones should be introduced as a buffer between two solid boundaries.
Solid boundaries (cont.)

Permeable boundaries

Environments with similar characteristics in terms of noise level or intensity can be separated by more permeable boundaries such as changes in level, plants or even just distance from each other. In many cases the two spaces being ‘aware’ of each other can actually be helpful. An example would be a café generating a suitable level of background noise for a between-lecture working environment.
CONCLUSION

We are confident that the Protolib project offers findings and designs that are of transferable value beyond the University of Cambridge’s libraries. Nevertheless their replication elsewhere would obviously require some exploration and understanding of the context in which they were to be applied. We would also advise that any efforts to recreate our main design suggestions for high, medium, and low intensity environments would need to be followed closely in order to yield satisfactory results.

Our approach to this research project was to try to abandon our preconceptions, experience and assumptions and instead immerse ourselves in library environments afresh in order to arrive at findings and design suggestions that were evidence-based and derived from real-life user behaviour in all of its surprising - and occasionally contradictory - complexity. Had we instead relied solely on the needs that users professed to have, or worse still on our instincts, we feel sure that we would not have gathered as rich and reliable a picture of current user experience in library spaces.

(Above: David Marshall affinity maps this findings report in sticky notes in the Protolib ‘bunker’)

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It is important to note the project constraints. We had hoped to explore group work and analysis spaces through prototyping, but this ultimately proved impossible in the timescales we were working to. Similarly we were unable to fully explore the complex matter of library staff in library spaces and the wider issue of the promotion of library staff expertise and support, although the initial findings herein have certainly whetted our appetite. Signage, wayfinding and zoning have also emerged as enticing topics for future research.

On a more local level, the project has reinforced to us what can be achieved when the University of Cambridge’s libraries community comes together to use its collective resource to spend time closely researching our users. This report is not the product of a handful of people but of well over 50 library staff, to whom we are very grateful for their time and contributions. We would also like to thank everyone at Modern Human for allowing us to fully experience and contribute to this project’s human-centred design process and for always being open to incorporating our own ideas and approaches. Special thanks to Modern Human’s Jenny Willatt who injected so much energy and commitment.

Futurelib continues to be a fast-moving programme, as it intensively researches - at relative breakneck speed - the user experience of Cambridge University’s students, researchers and academics with a view to delivering innovative and practical solutions to space and service design issues. Protolib has reinforced the value of this approach with its offering of a set of robust findings and recommendations that we consider to be practically applicable and insightful.

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