The Protolib II project

A user-centred evidence base for site-level library space design at the University of Cambridge

Futurelib and Modern Human – May 2017
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 of libraries and draws on the skills of librarians from around the institution to test new service concepts. It is funded by Cambridge University Library and supported by design and innovation consultancy Modern Human.

ACKNOWLEDGEMENTS

Futurelib Programme
David Marshall, Andy Priestner

Modern Human
Paul-Jervis Heath, Jenny Willatt, Pete Hotchkin, Chloe Heath and the rest of the team

Staff in participating libraries and who otherwise facilitated our work
Marjolein Allen (Reader Services, UL), Clair Castle (Chemistry Library), Federica Della Grotta (MML Library), Kasia Drabek (MML Library), Hélène Fernandes (MML Library), Rose Giles (Reader Services, UL), Nevenka Huntic (Rayleigh (Physics) Library), Patricia Killiard (Academic Services, UL), Kate O’Neill (MML Library), Steffi Palek (MML Library), Tuan Pham (Digital Initiatives and Strategy, UL), Mark Purcell, (Research Collections, UL) Libby Tilley (Arts and Humanities Schools Librarian), Mike Todd-Jones (Chemistry Library), Niamh Tumelty (Science, Technology, Engineering and Medicine Schools Librarian), Chris Young (Acting University Librarian)

Research and support
Sonya Adams, Christine Alexander, Liam Austin, Rosie Austin, Piotr Czosnyka, Jack Dixon, Martin French, Julian Fuller, Mary Kattuman, Megan Kelly, Kirsten Lamb, Natalie Kent, Jenni Lecky-Thompson, Heather Morton, Pri Pais, Katherine Sendall, Bethany Sherwood, Elaine Skidmore, Helen Snelling, Kotryna Stepanova, Tom Sykes, Celia Vartholomaiou, Meg Westbury, Louise Williams
Table of Contents

1. Introduction 1

2. The Original Protolib Project 2

2.1 Methodology 2

2.2 Key findings 2

2.3 Application of the Protolib findings in our research 3

3. The Protolib II Project 4

4. Methodology 5

4.1 Digital diary study 5

4.2 Geo-spatial data 5

4.3 In-depth interviews 5

5. Our Digital Diary Study 6

5.1 Statistical overview 6

5.2 Research process 6

6. Key Findings 7

6.1 There are 3 mind-sets that students apply to their course 7

6.2 There are 5 factors that influence people’s studying behaviour 8

6.3 People have two approaches to work/life balance 9

6.4 The location of someone’s college and department affects their needs 10

6.5 An individual’s timetable influences their studying behaviour 12

6.6 People find comfort in habit or are inspired by novelty 12

6.7 Attitudes to spontaneity influence study space use 13

6.8 People have different approaches to the ‘working week’ 15

6.9 Students have distinct types of social groups 16
7. Local Context

7.1 The topology of the University

7.2 Providing the right library spaces in the right places

8. A User-centred Range of Library Spaces

8.1 Responding to existing user behaviour

8.2 High intensity workspaces are still important

8.3 Intensity can be reduced by adding humanising features

8.4 Pockets of low intensity space are easy to introduce

8.5 Libraries with low print use should consider closed-access storage

8.6 The proximity of food can affect the use of library spaces

9. Site-level Design

9.1 The Sidgwick Hub: Intensity analysis

9.2 The Sidgwick Hub: Target intensity ratio

9.3 The Sidgwick Hub: Potential space relationships

9.4 The City Hub: Intensity analysis

9.5 The City Hub: Target intensity ratio

9.6 The City Hub: Potential space relationships

9.7 The West Cambridge Hub: Intensity analysis

9.8 The West Cambridge Hub: Target intensity ratio

9.9 The West Cambridge Hub: Potential space relationships

10. Design: Entrance Areas and ‘Landing Zones’

11. Conclusion
1. INTRODUCTION

The Futurelib Programme has been involved in the user-centred research and design of library services at the University of Cambridge since August 2014. Beginning in November 2015, alongside other work, the Programme has conducted targeted user experience research in order to provide an evidence base for evaluating and redesigning physical library spaces at the University. This work began with the Protolib project (http://bit.ly/protolibreport), which was conducted between November 2015 and April 2016. The focus of the project was to explore what types of physical library spaces might be necessary to support current user needs and behaviours at Cambridge. This involved prototyping spaces based on the findings of co-design workshops conducted with library users, then conducting further research with the prototypes in place. Key methods included immersive observations of the prototype spaces and talking to people using them about which activities the environments best supported and why. The resulting insights into library user behaviour led to concrete suggestions for the design of and relationships between individual library spaces. The Protolib project should be seen as both a precursor to, and an essential part of the research, findings and suggestions for design that are outlined here and we would strongly advise the reader to revisit the Protolib report before reading this document.

After the completion of the Protolib project there were still some important unanswered questions: How might we best design a suitable, user-centred network of spaces at a macro level; across University sites? How might we aid users in navigating these spaces? These issues were explored in the Protolib II and Tracker projects respectively, in order to arrive at a holistic concept for the design of library spaces. Protolib had given us the insights necessary to effectively design individual spaces, we now needed to zoom both out and in to fully understand what this meant in terms of site-level space design and implementation.

These micro- and macro-level issues were investigated through different research methods. The micro-level issues of how users navigate physical library spaces were explored through shadowing, observation and interviews, and through employing precise digital eyetracking glasses in order to see exactly where people looked when in need of assistance. The macro-level issues were primarily addressed by conducting a digital diary study with students from across different University disciplines and colleges and at different levels of study, followed by in-depth interviews with diary study participants.

The micro-level research and design will be detailed in a separate report. A full set of the design patterns arrived at over the course of the first Protolib project and our more recent research will also be published in a stand-alone document.
2. THE ORIGINAL PROTOLIB PROJECT

2.1 Methodology

To give the research, findings and design in this report their necessary context it is essential to reintroduce some of the key findings and insights from the original Protolib project. This project focused on the user-centred research and design of individual library spaces, and the relationships between these. In the initial phase of the project, co-design workshops with library users and library staff informed the design of prototype library spaces. These prototypes were implemented in existing University buildings, based on professed user needs; spaces designed for reading, writing, group work and other activities. Once these prototypes were in place they were observed and user behaviour was recorded in detail. We conducted interviews with people leaving the spaces, focusing on their experiences of the environments and what tasks and activities they best supported. We also gathered feedback through feedback walls, questionnaires and comment cards.

2.2 Key Findings

Working spaces vary in intensity. Our research found that intensity is a defining characteristic of library spaces. High intensity spaces are usually large, silent or close to silent, with a low level of transience, i.e. movement of people through the space. They have formal desks and chairs, a lack of humanising features and individuals working in these spaces are exposed to others working around them. Low intensity spaces are smaller, with the presence of soft furnishings and a welcoming atmosphere. Importantly low intensity spaces are relaxed but still facilitate study, with people conducting serious academic work. Medium intensity spaces are similar to high intensity spaces but smaller, less observed and with the presence of humanising features such as plants and artwork.

People have a hierarchy of working activities, which has a large influence on their choice of working environment. An individual’s primary activity makes up the largest part of their working day: examples include essay writing, revising, producing technical reports and writing dissertation chapters. Secondary activities support this primary activity but take a shorter time to complete: examples include reading a chapter from a book or article from a journal, discussing work with fellow students and checking references. Tertiary activities are not always academic in nature but nevertheless are an important part of an individual’s working day: examples include administrative tasks such as editing diaries and calendars, and communicating with supervisors, fellow students or colleagues via email.
People choose their working environment based on three factors: their working activity, the intended length of their visit and their current level of well-being. This is directly related to an individual’s hierarchy of working activities. It was a key emergent theme of the study that a person’s current level of mental well-being is an important factor in determining the space in which they decide to work.

For a complete understanding of how the findings and design of the Protolib project relate to the work outlined in this document, we strongly advise revisiting the project report: http://bit.ly/protolibreport

2.3 Application of the Protolib findings in our research

During the research outlined in this document we augmented the findings of the Protolib project in order to arrive at an evidence base which could inform site-level planning and design, helping to provide the right types of spaces at each University site. We assessed the existing spaces in light of our findings and suggested how the intensities might be re-evaluated, based on the needs and behaviours of their users.
3. THE PROTOLIB II PROJECT

Focusing on macro-level design and evaluating the provision of library spaces at the three main University sites, the Protolib II project involved conducting research with library users across the University in order to reach an understanding of their behaviours and needs; specifically, how, when and where they conducted different working activities. This was done to provide an evidence base which could inform recommendations for the design of physical library spaces at the three main sites across the University. We conducted a digital diary study with library users, some of whom were then interviewed in-depth after the study. This gave us a rich picture of their working lives at Cambridge and allowed us to focus on which of their needs could be better supported.

[Above: Protolib II Diary study participants attending an initial briefing session]

This ethnographic, open approach to research allowed us to reach a deep level of understanding in terms of the current needs and behaviours of library users at the University of Cambridge. We found out what activities they were engaged in both in and outside of library spaces, and what was truly important to them in terms of the environments they needed to support their working lives at the University.
4. METHODOLOGY

4.1 Digital diary study

- Conducted over 21 days using the dScout mobile app
- 41 participants from a range of disciplines and colleges
- Participants uploaded entries with information about what kind of study activity they were engaged in, where they were conducting that activity, what they were trying to achieve and how they felt at the time
- Participants uploaded photos or videos that clarified their entries further

4.2 Geo-spatial data

- Geo-spatial data was collected from diary participants, showing the locations they visited and the frequency with which they used different workspaces
- This data was mapped in order to show us areas of the University and city where people were conducting different working activities

4.3 In-depth interviews

- A number of participants were interviewed for between 1 and 1 ½ hours, after they had completed the diary study
- This allowed us to gain further insights into their working activities and lives at the University
5. OUR DIGITAL DIARY STUDY

5.1 Statistical overview

- 21 days
- 41 participants
- 16 colleges represented
- 16 academic disciplines represented
- 1,361 diary entries over the course of the study

<table>
<thead>
<tr>
<th>Disciplines represented</th>
<th>Colleges represented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian and Middle Eastern Studies, Anglo-Saxon, Norse and Celtic, Business (MBA),</td>
<td>Churchill, Clare, Corpus Christi, Downing,</td>
</tr>
<tr>
<td>Computer Science, Economics, Education, Engineering, English, Geography, History,</td>
<td>Fitzwilliam, Hughes Hall, King’s, Magdalene,</td>
</tr>
<tr>
<td>Human, Social and Political Sciences, Law, Mathematics, Modern and Medieval Languages,</td>
<td>Murray Edwards, Pembroke, Queens’, Robinson, Selwyn,</td>
</tr>
<tr>
<td>Natural Sciences, Philosophy</td>
<td>St Catharine’s, Trinity Hall, Wolfson</td>
</tr>
</tbody>
</table>

5.2 Research process

The diary study gave us valuable insights into where people were conducting activities that supported their studies and research, both in and outside of University buildings and spaces. It also taught us about their motivations; why they were using different spaces for different purposes. In order to arrive at a more holistic knowledge of their lives at Cambridge, however, it was important to interview some of the participants in-depth about their experiences.

Futurelib research projects gather a combination of attitudinal and behavioural data. While it is vitally important to understand the behaviours of our users and the activities they are engaged in, it is also necessary to find out what their opinions are about libraries and other aspects of the University and its services. The diary study interviews during this project gave us the opportunity to talk to a variety of different members of the University and to delve deeper into what was important to them, adding to the insights we had gained from their diary entries. This in-depth knowledge of our participants would not have been possible without these conversations.
6. KEY FINDINGS

6.1 There are 3 mind-sets that students apply to their course

Our research supported the development of three Cambridge student archetypes that were originally presented as personas by Cambridge University Library. Each archetype has a different motivation for studying at Cambridge and this directly influences their study behaviour, values and expectations of library services; including, but not limited to, the provision of resources and of environments in which to study.

**Grafters**: “I need to work really hard”

These students are always busy. They put a large amount of effort into their academic work and see this as the most important part of their life at Cambridge. They feel the pressure of having a heavy workload and respond by being extremely organised. Their ultimate goal is to finish their course with the highest level degree possible. They are often unsure of themselves and work harder as a result. They put themselves under pressure to achieve and feel they are letting others down when they don’t meet the expectations they have of themselves. For these individuals, maintaining solid social relationships despite their workload is of paramount importance in terms of coping with the pressure.

**Networkers**: “It’s a means to an end”

These students believe that a degree from the University of Cambridge will open doors for them in their future careers. They are not as committed to their chosen course of study as the grafters, as they see it partly as a means to an end; their future career is their highest priority. These individuals often feel that extra-curricular activities will be as important for their futures as their degree. They use these activities to build a network of contacts for the future. They will carefully prioritise activities and this may, for example, lead to them skipping lectures in favour of supervisions and concentrating on performing duties such as being JCR President.

**Balancers**: “It’s important to find a balance”

These students are aiming to do well but are also conscious of wanting to enjoy their time at Cambridge. They will often have selected subjects they enjoyed at school to study at degree level. They realise that they would have to work exceptionally hard to achieve a first-class degree and don’t believe that the extra dedication required is worth the effort. Instead, they are aware that a 2:1 from Cambridge will be sufficient for them to start their career when leaving the University.
Their goal is to find an effective balance between their studies and the rest of their life. They are attempting to find a balance that will enable them to achieve a good degree, minimise their stress levels and allow them to enjoy their time in Cambridge.

6.2 There are 5 factors that indicate people’s studying behaviour

The data gathered during our diary study and the interviews we conducted with participants supports the idea that there are 5 main motivating factors behind an individual’s studying behaviour. When and where a Cambridge student chooses to study is driven by:

**Location**

Where is a student’s college, where is their department and where are they at the time they are deciding where to work?

**Timetable**

How many ‘study events’ (lectures, lab sessions, classes, seminars, supervisions, etc.) does a student have scheduled per week? Some students have a very full timetable (NatSci students, some MML students), whereas other students have more self-directed study time (History students, English Literature students).
Work/life balance
Participants in our research took one of two opposite approaches to balancing their studies with the other aspects of their lives. They either tried to integrate their work into their lives, or tried to maintain a strong separation between their work and the rest of their lives. Both strategies were seen as being successful for different people and both strategies had an influence on studying behaviours.

Habit vs Novelty
Some of our participants found novelty liberating and that it helped them to refresh their focus. They actively looked for new and different study locations and different people to work with or around. Others were found to prefer a known, comfortable and well rehearsed routine. Both of these approaches seemed to work successfully for the individuals that exhibited them.

Planning vs Spontaneity
We witnessed a difference in behaviour between participants who planned their working activity carefully and stuck to those plans, and those who acted spontaneously and found that in this way they could study productively.

6.3 People have two approaches to work/life balance
The participants in our diary study exhibited either an attempt to integrate their studying activities into their wider lives, or an attempt to separate these activities from the rest of their lives. These two contrasting approaches to achieving a work/life balance led to two very different approaches to studying, both in terms of time and location.
Participants who separated their studying from the rest of their lives had a number of approaches to achieving this. They often kept very specific working hours and deliberately set aside time when they would not work. They had a number of locations that they studied in and importantly also had places in which they would never study. They imposed these stringent rules upon themselves and felt disappointed and frustrated if they were forced to compromise. For these individuals, having a clear distinction between studying and other aspects of life was necessary and reassuring.

One of the PhD students in our study had a working life which encapsulated this approach. She would actively try to avoid working in her room, would start work at 8am and work through until around 6pm. She would never work at the weekends. She imposed very clear boundaries between her work and the rest of her life. This student seemed to be engaging and progressing with her course successfully and enjoying her time at the University.

In direct contrast to the behaviour described above, the participants in our research who intergrated their studies with the rest of their lives weaved these activities together interchangably. They often reported fitting study activities around other life tasks they had to complete. Their diary entries showed that they were reading and completing tasks set in supervisions whilst cooking or eating. They would sit in bed reading when they first woke up or before going to sleep. They considered intergrating their studies into their wider lives to be the most efficient use of their time. For these individuals, achieving work/life balance hinged on the freedom to move from a study task to a life task and back again.

Both these approaches seemed to be successful for various participants in our research. However, the approach an individual adheres to will be a key indicator of their studying behaviour; it will influence when and where they choose to work.

6.4 The location of someone’s college and department affects their needs

Our diary study found a clear relationship between the location of a student’s college and department and where, when and how they chose to study. This supports the findings of previous Futurelib studies and the ‘student triangle’ concept arrived at during research conducted by Cambridge University Library.
Students whose college and department are located in or near to the same University hub have a lot of choice in terms of where they can study, and can be more flexible about when and where they complete their working activities. In contrast to this, students whose college and department are geographically distant from each other have more restrictions placed on when and where they can study and as a result exhibit very different behaviour. These individuals often have gaps in their timetable that are too short for it to be practical for them to travel between their college and their department. In these situations, people tend to travel to their department for their first lecture or class, staying there until these scheduled activities are over for the day. They rely on being able to find spaces to work that are in or near to the department, between lectures and other activities. Their approach to structuring their study activities and working days is often very different to that of individuals whose college and department are closer to each other.

The findings of the Protolib project showed that where possible an individual will choose their working environment based on their intended activity, the intended length of their stay and their current level of well-being. Students whose college and department are in or near to the same University hub other are able to move between spaces in the college and department at will, and therefore have the facility to choose workspaces in this way. It is important to note, however, that due to the proximity of their regular working locations the likelihood of them moving outside of the hub will be relatively low.

It is essential when planning and designing workspaces that both these situations are considered and catered for. Although our diary study research was conducted with undergraduate and postgraduate students, similar concerns are present for postdocs and academics. The distance between the core environments that support the working lives and activities of an individual contribute to when and where they conduct their work.
6.5 An individual’s timetable influences their study behaviour

The number of timetabled ‘study events’ (lectures, lab sessions, classes, seminars, supervisions, etc.) varies widely for students in different disciplines and at different stages of study. For example, most undergraduate Natural Sciences (NatSci) students will have lectures, lab sessions and supervisions; much of the time they spend working towards their degrees will be spent attending scheduled study events. The timetables of some undergraduate Modern and Medieval Languages (MML) students are similar in many ways, as they too have a range of different types of scheduled study events. These can include lectures, supervisions, grammar classes and translation classes. For students taking highly structured courses, preparation for supervisions, reading and other study activities take place around the scheduled events in their timetable. Their use of libraries and other study spaces is for multiple, shorter periods of time.

Students taking less structured courses have fewer prearranged study events but are expected to do more self-directed work. Their non-scheduled study activities often form large units of time within their working days. These students will tend to spend longer on a single self-directed study activity (e.g. reading or writing an essay). They are more likely to spend time planning where they will work, build a habit around a single study activity and use the same space across multiple visits to complete that activity. It is probable that their visits to libraries and other study spaces will be for longer periods of time.

When people are anticipating spending a long time in a space, they are likely to spend more time choosing that space and to be prepared to spend longer travelling to it. Their level of investment in the environment and the facilities it provides will be higher. Once in the space they have chosen and travelled to, they are likely to stay for several hours, or most of the day. It is important that these destination environments and buildings have spaces and facilities that support breaks, eating lunch and switching to a less intensive environment in order to refocus. This allows people to maintain their productivity and increases their endurance when they are working for sustained periods of time.

6.6 People find comfort in habit or are inspired by novelty

Some of the participants in our diary study exhibited clear habits. These individuals often established a daily and/or weekly routine, returning to the same places to conduct certain types of
work. These habits and rituals helped them to focus and study effectively. Other participants exhibited behaviour opposite to this; they found that changing their routine, varying their activity and working in new places helped them to remain interested in their work and to study effectively. Occasionally our participants reported having changed this behaviour, breaking their routine when they recognised that their usual habits were not proving effective. This was sometimes due to changes in their work and their schedules, for example undergraduate students moving into the third or fourth year of their degree programme. On other occasions it was due to people becoming unsatisfied with their current routine and actively looking for inspiration and motivation.

In subjects where people have a lot of small units of work to complete, habits build around this work. A NatSci student may complete problems they have been set at supervisions in the same study space at similar times each day. A student with larger units of work, for example a History undergraduate, may build habits around activities such as reading, writing and proofing their work. Students who find habits comforting and effective are likely to arrive at a successful habit or set of habits and stick to this for at least an academic year. People who rely on novelty to maintain their interest may go through periods of habitual behaviour, but these are often short and punctuated by their more dominant novelty-seeking behaviour.

There are two distinct behaviours present in the users of our physical library spaces. The first behaviour is displayed by the habitual user, who knows the space well, is likely to aim for the same seat each day and would prefer if possible to leave working materials there to return to. The second is displayed by the novelty-seeking user, who is less attached to the space and more likely to be a transient or occasional user.

6.7 Attitudes to spontaneity influence study space use

During our research we witnessed differences in behaviour between participants who planned their study activity carefully and stuck to those plans and those who enjoyed acting spontaneously and relied on this to continue studying productively. These were related to the preference for either habit or novelty but are worth mentioning in their own right.

Some of our participants planned their work in advance. Different levels of planning were observed, for example, an undergraduate student planning their activity would do so in terms of the week between their supervision and the date they needed to hand in their work, also planning carefully
for each day in that period. Interestingly most participants preferred paper diaries for planning their activities, some also used loose sheets of paper so that they could attach their plans to noticeboards in their rooms or where they studied. Only one of our participants was making use of digital technology to assist with their planning.

Most participants who had completed their first year of undergraduate study or further were organising their time in some way. A key emergent theme, however, was that a number of participants clearly felt more inspired when they allowed themselves the freedom to act spontaneously. This helped to alleviate feelings of stress they experienced due to their workload. Often these individuals would plan to complete the work they had been set no sooner than the time dictated by the deadline. They would also intentionally leave some of their time and aspects of their work unplanned to allow for a level of spontaneity. Participants who preferred planning felt uncomfortable and under pressure when they were forced to deviate from their plans, or when their tasks took longer to complete than they had anticipated. People who valued spontaneity were more resilient to these changes.

People that carefully plan their time will have clear ideas about where they want to study, what they want to accomplish and what resources and equipment they will need to complete their tasks. They are likely to have a fixed plan in place for each piece of work they are set. If their chosen workspace is fully occupied or if resources they need are suddenly unavailable, this is likely to inconvenience them and detract from their work in a way that it would not with more spontaneous individuals.
6.8 People have different approaches to the ‘working week’

Our diary study participants exhibited very different approaches to their ‘weeks’ and ‘weekends’. This largely depended on their level of study and the nature of their course. Undergraduate students who were set essays during the week tended to plan their weeks around this existing activity. Often their ‘weekend’ would fall directly before or after being set an essay and was constructed to fit in with their supervision cycle.

We witnessed very similar behaviours across all our undergraduate student participants who had to complete essays as part of their course. These students would typically spend 3 days reading for an essay, 2 days writing the essay and between 1 and 2 days proof reading and completing the essay. Their ‘weekend’ tended to be 1 or 2 days directly before or after this cycle. This is an important consideration for Cambridge libraries as many are open Monday to Friday, with restricted hours on Saturday and Sunday. The opening hours of our libraries do not necessarily always reflect the working patterns of our users. This also applies to teaching academics at the University, who can often only find time to visit libraries in the evenings and at weekends.

The MPhil students who took part in our research tended to have a Monday to Friday routine, which was partly dictated by their timetable. This group of students found it easier to leave Saturday and Sunday free. PhD students had the most control over how their time was spent. Some tended to work every day and to all intents and purposes not have a ‘weekend’, others consciously worked Monday to Friday and wherever possible did not work on Saturday and Sunday. This is linked to how people approach their work/life balance. PhD students who consciously separated work and the rest of their lives were more likely to carve out a weekend for themselves and this was often Saturday and Sunday. Those who intergrated their studies with the rest of their lives were much more likely to work at weekends and often referred to their PhD as all-encompassing.

Religious observance had a strong influence on how participants structured their weeks, with those following a religion often leaving Saturday or Sunday as a day without work or study in order to focus on this.
6.9 Students have distinct types of social groups

During interviews with our diary study participants we asked them to map their friendships and acquaintances in Cambridge. During these discussions we learnt a lot about how people develop social groups during their time at the University. These social dynamics exert a strong influence on the study behaviours of individuals and therefore on their use of library services. Two key types of social group were identified during our research:

**Given Groups:** These are social groups that are constructed by the University, either deliberately or accidentally. They include groups such as college families, students who live on the same college staircase and class groups (lab groups for NatSci students, classes for MML students and MPhils). Interestingly, we found that students did not consider their membership of larger groups (lecture groups and colleges for example) anywhere near as important in terms of developing social relationships. Our participants did not feel connected to those in their lecture groups or colleges unless they had something else in common or had previously met.

**Emergent Groups:** These form when an individual chooses to become part of a social group. For our participants these groups had sometimes occurred haphazardly and were sometimes borne out of shared interests and pursuits, such as being members of a particular University club or society.
Over time people naturally move from their given social group to their emergent group or groups. There is a level of overlap and people may join each other moving from a given to an emergent group. Our research has shown us that people do not spend more than a year or so relying purely on their given group. This has clear implications in terms of people who spend shorter or longer amounts of time at the University. Our diary study focused on the lives of students but it is easy to imagine that similar situations exist for postdocs and other University staff.

In terms of the user groups we worked with in this project the involvement in given and emergent social groups was typically as follows:

**Undergraduate students:** At the start of their course undergraduates are typically very reliant on their given social groups. As they spend more time at the University other groups emerge and these are the relationships that tend to last for the rest of their degree course, often past graduation. The importance of given groups should not be underestimated; they are vital in allowing students to make friends when they start their course, as are social events at colleges and University clubs and societies.

**MPhil students:** The MPhil students who participated in our research were very aware that they had a limited time in which to form social groups (around 12 months) and had arrived at the University anticipating a heavy workload and a busy timetable. The University creates given groups for these students; their MPhil class group becomes their primary social group. These classes tend to be made up of less than 20 people. MPhil students do not spend enough time at the University to develop emergent social groups; most of our participants had come from universities outside of the UK and had clear ideas about what they wanted to do after graduating. There will naturally be differences for students who have completed undergraduate study at Cambridge or who know that they will be continuing at the University after receiving their master’s degree.

**PhD students:** The most interesting user group in our diary study in relation to social groups were PhD students. Full-time PhD students spend as many years studying for their degrees as undergraduates do and part-time PhD students can take even longer to complete their courses. A key difference is that the University does not provide PhD student with given social groups in the same way as it does for undergraduates.

Several of our diary study participants were embarking on the first year of their PhDs. These first-year PhD students were all studying full-time. A common feeling amongst these participants was
that of abandonment and loneliness; this was in part due to the fact that they had very little structure in their PhD programmes. Many reported that in the initial stages of their degree they were spending most of their time reading but did not have a clear sense of where they were heading with their work. People mentioned having had a negative experience and felt that there was not enough value in their course for the significant fees they were paying. The early research phases of a PhD will inevitably feel directionless to an extent, however, more can be done to facilitate a positive introduction to the University and its services for PhD students.

At the start of their programmes PhD students should be afforded some of the support mechanisms and opportunities to make contact with other students that undergraduate students are offered. Many PhD students will have recently moved to Cambridge, others may have changed college. Placing these individuals within given social groups would help make this transition a more positive experience. The findings of this study and previous research conducted by the Futurelib Programme suggest that there is a strong link between the strength of an individual’s social group and their resilience to heavy workloads and pressure.
7. LOCAL CONTEXT

7.1 The topology of the University

Previous research conducted by Futurelib and Cambridge University Library has highlighted the importance of the geographical arrangement of colleges, department and faculty buildings and other University facilities. The ‘Hubs and Halos’ model identifies 3 key University ‘hubs’, which each contain a concentration of University buildings and facilities. The areas surrounding these hubs, their ‘halos’, have a lower concentration of these buildings and facilities. The 3 hubs identified are the Sidgwick Hub, the City Centre Hub and the fast-expanding West Cambridge Hub. A full explanation of this model can be found in the original Protolib report (p39-41). An individual’s use of working environments and libraries at the University is heavily influenced by the location of their college and their department, and whether these two locations are in the same hub or in separate hubs. People will behave very differently based on these factors.

7.2 Providing the right library spaces in the right places

When considering the design of 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 existing balance of types of spaces in the surrounding area, in Cambridge’s case - across a hub. Cambridge should be viewed as a network of linked and interrelated library and non-library spaces. 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. More information about this approach can be found in the original Protolib report (p42).
8. A USER-CENTRED RANGE OF LIBRARY SPACES

8.1 Responding to existing user behaviour

The modus operandi of the Futurelib Programme is to design Library services and spaces which respond to and support existing user behaviour. Over the course of our research into library space use and design a key emergent theme has been that students and other members of the University use a variety of spaces and a number of different libraries to support their working activities. During the first Protolib project the term ‘Sidgwick Nomads’ was coined to describe students who moved at will between libraries on the Sidgwick site. Participants in the Protolib II diary study exhibited similar nomadic behaviour.

Students in our diary study often used libraries and other spaces away from their own department. They sometimes felt that they were breaking the rules, even when working in libraries that would have welcomed them. Often their discovery of these spaces had happened through conversations with other students, or through their own exploration. Students who did not make use of a range of facilities and spaces in this way often found themselves studying in less than ideal environments.

Our participants used between 1 and 12 different study spaces over a period of 21 days (in late Michaelmas Term 2016). Most of these individuals had been at the University for over a year and exhibited regular habits. On average, people used 5 or 6 different study spaces over the three weeks. These statistics suggest that this nomadic behaviour is present in the way the majority of students approach their studies, and their use of library and non-library study spaces.
In order to provide a network of workspaces which appeal to a wide variety of library users with different preferences, the fact that students and other members of the University do not feel tied to their ‘home’ library any more should be utilised. Our research has confirmed that:

- There are a rich variety of library spaces at the University, with different intensities
- Individual library users need a variety of environments to study comfortably and effectively and to maintain their productivity
- Many library users already move between different library spaces

This would suggest that the most efficient use of resources would be to create a network of library environments that differ in nature and intensity and which are available to members of the University, regardless of their department or faculty. Cambridge college libraries are the natural exception to this and will continue to cater for the needs of their own members.

8.2 High intensity workspaces are still important

Although Futurelib research has shown that there is a need for more low and medium intensity workspaces in Cambridge, it is important to remember that high intensity spaces should still be provided. These spaces are highly effective for people working to deadlines and in need of extrinsic pressure, for people trying to get away from distractions while they work and for prolonged periods of intense concentration. They are typically used for tasks which take a long period of time, such as writing essays, articles and book chapters and are highly valued by students revising for exams.
Some library spaces have architectural features that to a large extent determine their intensity. The main Reading Room at the main University Library is a beautiful workspace, which provides its users with the disciplined environment they need to focus and brings to mind the generations of Cambridge scholars who have worked there over the years. This is also the case for the Seeley Library; the impressive building this library is situated in has won architectural awards and its features lend themselves to a quiet, disciplined working environment. It would be difficult or impossible to lower the intensity of some spaces of this nature and many people need high intensity workspaces to be productive. These environments existing alongside low and medium intensity spaces elsewhere would mean that a wide range of needs and preferences are catered for.

8.3 Intensity can be reduced by adding humanising features

[Above: Library users working opposite each other in our medium intensity prototype workspace]

The intensity of many existing library spaces at the University could be lowered with the addition of simple, low-cost, humanising features. These often have practical benefits as well. Examples include individual task lamps, which allow people to customise their immediate environment; this humanises the space as it allows people to personalise their individual area and gives them a sense of control. Task lamps were a key element of the most successful iterations of the prototype medium intensity space designed during the first Protolib project. Another successful element of this space was the inclusion of plants. When both task lamps and plants had been installed in the medium intensity space under study, peak occupancy increased from 13 to 18 people and mean occupancy from 12 to 14 people (the space could accommodate 20 people in total). Plants also acted as sightline blockers, which meant that people were more comfortable sitting opposite and diagonally opposite someone they didn’t know to begin their work.
8.4 Pockets of low intensity space are easy to introduce

The value of low intensity workspaces should not be underestimated and careful thought should be given to ensuring that these are adequately provided across a network of library spaces. As low intensity workspaces are relatively small in size, they can be easily installed in previously unadopted areas within buildings, or areas which are underused and have the potential to be repurposed.

Our research has shown that people need a variety of different intensity workspaces in order to be productive and maintain endurance whilst working. The relationship between these spaces is important, as people will need to move from a high intensity workspace to a medium or low intensity workspace and back again at points during the course of their day. Another key consideration is the levels of transience in these spaces; a high intensity workspace will lose its studious atmosphere if there are too many people moving through it, whereas medium and low intensity workspaces can accommodate a higher level of transience. Low intensity workspaces should not be placed in thoroughfares, but can be successful in areas of library buildings where people move around reasonably frequently.
8.5 Libraries with low print use should consider closed-access storage

This is a key concern for new library buildings and is also an important factor to consider when the opportunity arises to re-house physical collections. During our research we witnessed some libraries with very occasional collection use, but that were valued highly as study spaces. In cases such as these, library users were also less experienced in the processes involved in finding physical resources and navigating library spaces and collections. These individuals found the task of locating books and journals more difficult than their counterparts in disciplines which rely more heavily on the use of printed material.

In some libraries collection use is so infrequent that users essentially have to relearn the way the library and its classification system works each time they need a physical resource. In these cases, if collections were moved to closed-access areas, physical resources could be ordered to the open library spaces and areas previously occupied by book stacks, and printed collections could be replaced with environments conducive to study, with varying intensities.

8.6 The proximity of food can affect the use of library spaces

Although it will not always be the role of a library to provide its users with food, it is nevertheless an important part of an individual’s working day and has a large impact on the way in which they work and manage their time. This in turn directly affects their use of library and non-library study spaces. Participants mentioned during our research that the lack of suitable food options near their department meant they often returned to their college for lunch, in their opinion wasting time that they could have been using to study. A third year History undergraduate student from Murray Edwards College commented:

- “A panini for lunch is sometimes as good as it gets on the Sidgwick site.”

This opinion was not uncommon amongst people whose department was located on the Sidgwick site. Previous Futurelib research with students and researchers working on the West Cambridge site has shown that people have similar concerns about the food options available to them there. In order to encourage people to continue to use library spaces it is important that they have access to healthy, hot food in the vicinity. In Cambridge, this could be achieved in a number of different ways, for example with the addition of more street food vans to University sites, or through the increased promotion of existing cafes and other eateries in nearby colleges.
9. SITE-LEVEL DESIGN

The intensity gradient for library spaces arrived at during the first Protolib project gave us a framework with which to analyse the current provision of library spaces at the University of Cambridge. The following pages of this document outline the current ratios of different intensity spaces at each University hub. Based on our research with library users from different disciplines and colleges, they suggest how these ratios could be re-evaluated to create a more user-centred, suitable network of library spaces. All the figures provided are approximate and we would recommend that any new or re-designed library space should be prototyped, tested and refined according to the needs and behaviours of the user population.

9.1 The Sidgwick Hub: Intensity analysis

Expected user base:
The Sidgwick site contains a large number of University department and faculty buildings in the schools of Arts, Humanities and Social Sciences. Many of the disciplines represented rely heavily on the use of monographs and other printed resources. This is a key factor in determining the relationships people based on the site will have with the libraries there and will influence the use of library spaces. It is worth bearing in mind that there will also be members of disciplines in the STEM (Science, Technology, Engineering and Medicine) School resident at the colleges near to the site (Selwyn, Newnham and Robinson) and at the further six colleges that are close enough to be considered part of the Halo for the Sidgwick Hub.

Balance of environments across the hub:
Our analysis has shown that at present the Sidgwick Hub has a large proportion of high intensity workspaces. For purposes of our analysis and design recommendations we have included the main University Library (UL) when listing the study spaces available at the Hub. There are large high intensity spaces present at the Sidgwick Hub, such as the main Reading Room and West Room in the main UL and the main study area in the Seeley Historical Library. In order to re-evaluate the intensity of the Hub as a whole, it is important that more variety is created within the other spaces available.
Local context:
The Sidgwick site is located outside of Cambridge city centre and it takes a considerable amount of time for those based at the Hub to travel elsewhere. The Hub therefore needs to be self-contained and provide break spaces and a range of food options, as well as a suitable range of study spaces.

Key opportunities:
A key opportunity on the Sidgwick site is to take advantage of the wide range of library spaces to create a more suitable, user-centred range of study spaces. We would recommend lowering the intensity of many of the spaces. Simple modifications can reduce the intensity of many existing environments; this could be the addition of simple humanising features such as individual adjustable lighting and indoor plants. We would recommend that in a lot of cases chairs should be removed; this helps to lower the intensity of workspaces as people feel less observed by others working around them. The original Protolib project proved that removing chairs from a workspace can in fact increase its occupancy. It would be possible for more chairs to be reintroduced to spaces at peak periods when more individual workstations may be needed. More low intensity spaces on the site would support the needs of people who want to be focused, but also relaxed, while reading and conducting other working activities, before returning to higher intensity workspaces.

9.2 The Sidgwick Hub: Target intensity ratio
While allowing for some variance, it is clear that high intensity environments make up the majority of the workspaces on the Sidgwick Hub. Our research has shown that many users will spend a long time reading, or using the libraries there for long work or study sessions. Providing more low intensity environments will allow people to maximise their productivity and switch between primary, secondary and tertiary working activities to refresh their focus. We would also suggest that more medium intensity spaces are provided, to support people who wish to complete their primary and secondary activities in less intense environments than are currently offered. Medium intensity environments are also designed to support people working with multiple resources and using both print and electronic media. Those individuals who are productive in high intensity environments will continue to be well catered for.

9.3 The Sidgwick Hub: Potential space relationships

The diagram below illustrates approximate relative space sizes and relationships between spaces. The diagram shows one potential future configuration of different intensity study spaces and break spaces at the Sidgwick Hub. Many other configurations with similar relative space sizes and benefits are possible and should be considered. This potential future configuration has been designed based on current user needs and behaviours at the University.
9.4 The City Hub: Intensity analysis

**Expected user base:**
The departments located at the City Hub (the New Museums site and Downing site combined) are a mixture of Sciences, Humanities and Social Sciences. There are also a significant amount of colleges within the City Hub and its Halo. This means that at present the City Hub has the broadest potential user base of the 3 hubs in the Hubs and Halos model. The concentration of colleges means that many users of the University buildings and facilities within the Hub will be at a college which is close to their department or faculty, and will be able to easily move from one to the other.

**Balance of environments across the hub:**
There are currently a number of both medium intensity and high intensity workspaces within the City Hub. Our analysis has shown that at present the split is close to 50% medium and 50% high intensity. Provided that people feel able to move between these different workspaces the site offers a good choice of environments, with the exception being the current lack of low intensity workspaces. It is important to note that although there are many cafés in and near to the City Hub, this does not mean that low intensity workspaces are not needed. Low intensity workspaces are different in that they are designed to be relaxed but serious, and conducive to study.

**Key opportunities:**
At present the buildings and spaces in the City Hub can feel separate and disjointed. There is an opportunity for a network of different intensity study spaces that members of the University can move between freely. The Hub should still feel like part of the city centre but also be more defined as a distinct part of the University.

9.5 The City Hub: Target intensity ratio
Based on the range of disciplines represented at the City Hub and the user behaviour we have witnessed during our research, we would recommend introducing some low intensity workspaces, to better support secondary and tertiary working activities. The location and context of the site means that fewer low intensity spaces may be needed than at other University sites, as some people will be conducting these activities in public spaces in the city. This does not, however, completely remove the need for well-designed quiet, serious, low intensity workspaces.

9.6 The City Hub: Potential space relationships

The diagram below illustrates approximate relative space sizes and relationships between spaces. The diagram shows one potential future configuration of different intensity study spaces and break spaces at the City Hub. Many other configurations with similar relative space sizes and benefits are possible and should be considered. This potential future configuration has been designed based on current user needs and behaviours at the University. It is worth noting that outside the City Hub, but near enough to be considered part of its Halo, are large University buildings such as the Judge Business School and the Engineering Department. Some areas within these buildings are open to all members of the University.
9.7 The West Cambridge Hub: Intensity analysis

**Expected user base:**

The West Cambridge site has a strong focus on Engineering and other Science and Technology disciplines. Members of these departments will be completing activities and tasks which are different in nature to members of other disciplines. An example is that of undergraduate students, who for a large amount of their time at Cambridge are solving problems or answering questions set by their supervisors. Futurelib research has shown that students often conduct these activities working alone but surrounded by other people working. This allows them to stop at points to ask each other questions about the problems they are working on. Workspaces inside the West Cambridge Hub should be designed to support this activity, i.e. people working quietly but being able to talk occasionally. The Hub should still also support silent work and study in some areas.

The colleges of most University members will be outside of, often a distance of miles from, the West Cambridge Hub. This means that spaces inside the Hub will see a large level of transience; people moving in and out of the spaces to attend classes, lectures and work in labs on the site. It is important to provide workspaces where this behaviour is facilitated, but also to reserve some spaces where people can engage in longer, silent working activities. A number of medium and low intensity spaces should be provided, with ease of access and movement. Buildings which take more time to travel to and are more removed from the busy parts of the site should be reserved for higher intensity workspaces. As mentioned previously, our research has shown that people are more likely...
to invest in a space and to travel further to it if they know they will be engaged in their primary working activity for a long period of time.

The fact that many people will realistically not be able to travel back to their college during a day working or studying on the West Cambridge site has a number of implications for space planning. In terms of workspaces, there will be an increased need for spaces that support short study activities between lectures. Seating and work surfaces in areas between lecture theatres will help to support this activity. The first Protolib project reports details our research into between-lecture workspaces and the resulting suggestions for design, along with those for low, medium and high intensity workspaces, break spaces and other environments. http://bit.ly/protolibreport

The distance between most Cambridge college buildings and the West Cambridge Hub means that careful consideration needs to be given to the services and facilities available. People will need access to facilities that enable them to stay at the West Cambridge site all day, including break spaces, and a range of healthy and affordable food outlets which can cater to large numbers of people at peak periods.

**Balance of environments across the hub:**

Our analysis of the current balance of workspaces at West Cambridge suggests a strong bias towards medium intensity working environments. A single, large, high intensity workspace would readdress that balance at this stage in the development of the site. As the site continues to develop, the balance of intensities should be constantly evaluated and further research should be conducted, to ensure it remains able to support the needs and behaviours of those using the site.

**Key opportunities:**

The distinct nature of the West Cambridge Hub means that a considered approach will be needed if it is to support the working lives of University members based there. This needs to take into account the fact that students and other members of the University will often need to spend all day at the Hub, due to its location. Our research suggests that the work of students based at West Cambridge is likely to be conducted in shorter sessions. Library environments should take this into account by providing medium and low intensity working environments which can support a reasonable level of transience, without having a negative effect on the productivity of their users.
9.8 The West Cambridge Hub: Target intensity ratio

Due to the distance between the West Cambridge Hub and most Cambridge colleges and other facilities, we would recommend focusing on providing environments which cater for studying and work which happens between other scheduled activities people will be conducting at the site. Particularly in the case of students, our research has shown that many will have busy timetables with labs, supervisions and other scheduled activities. These individuals will need spaces in which they can complete short working activities, either alone or working surrounded by other people. The focus on medium intensity workspaces at the West Cambridge Hub should continue, with an emphasis on working environments that are not strictly silent but that are still serious and conducive to academic work. There should also be some provision of high and low intensity workspaces, to support different working preferences, activities and levels of well-being. This will allow people to vary their working environment when spending an entire day at the Hub.

9.9 The West Cambridge Hub: Potential space relationships

The diagram overleaf illustrates approximate relative space sizes and relationships between spaces. The diagram shows one potential future configuration of different intensity study spaces and break spaces at the West Cambridge Hub. Many other configurations with similar relative space sizes and benefits are possible and should be considered. This potential future configuration has been designed based on current user needs and behaviours at the University. It is worth noting that the West Cambridge Hub is expanding rapidly; as previously mentioned, continuous evaluation of the Hub and its user base will be needed in order for it to continue to be successful in supporting the working lives and activities of its user population.
The Betty and Gordon Moore Library is included in this diagram and is marked here as ‘Maths’. As well as supporting the Faculty of Mathematics the Moore Library also holds a significant part of the University Library’s Legal Deposit holdings and supports teaching and research across many of the scientific disciplines. The Moore Library is included in our analysis and suggestions as members of many University disciplines use the spaces inside the building to study and conduct research.
10. DESIGN: Entrance areas and ‘landing zones’

After the first Protolib project there were some individual types of library spaces that we wanted to study further, specifically non-working spaces such as entrance areas and landing zones (spaces designed to facilitate transitions between different types of working environments). We observed activity in these areas over the course of our recent research, in the libraries we were conducting eyetracking work in as part of the Tracker project (http://bit.ly/trackerproject). The following suggestions for the design of these environments augment the suggestions for library spaces contained in the report for the first Protolib project.

Entrance areas

The entrance area of a library should be a welcoming and informative space, which forms an ideal starting point for a user’s journey through the library and its individual spaces. Common activities in these spaces include meeting people, borrowing and returning books, and asking for information and assistance. It is important that people are able to orientate themselves within this space and navigate easily to other areas of the library and to the resources they need. Navigational aids in the form of signage and maps should be included in the space. Areas with seating and clear surfaces should be provided, to accommodate people waiting for friends and colleagues. These would also assist people needing to empty bags, to return books or to prepare their working materials before using the library. Our research has shown that service and information desks should be placed to one side, to avoid seeming confrontational and to enable people to approach them with confidence. Separate rooms and even glass walls can create a perceived boundary which can prevent library users approaching staff for assistance.
Signage in entrance areas should fulfill two main functions. Signage should be provided at the first point of the entrance area, its purpose being to inform users of the rules of the library they are entering and of other important information specific to using that library. Examples include opening hours for the library, whether hot drinks are allowed inside and information about the workspaces spaces available in the library building. Once inside the entrance area, navigational signage should be provided to help people orientate themselves in the space and find their way to the area of the library they need.

**Landing zones**

Landing zones should be present not only in library entrance areas, but also in spaces where people need to transition to library spaces with different intensities. If designed appropriately they can provide distinct cues that prepare people for a change of behaviour appropriate to the space they are entering. Before entering a high intensity workspace people may wish to retrieve the materials they need to work with from their bag, to avoid disturbing people once they are in the space. They may also want to speak to people before entering the workspace for similar reasons. This activity can be catered for with a simple table and armchair or sofa placed next to the entrance to the high intensity workspace. In areas with larger volumes of traffic, landing zones should be designed to accommodate a larger number of people.
11. CONCLUSION

The network of libraries and physical library spaces at the University of Cambridge is incredibly rich and diverse. This is part of what makes Cambridge such an attractive setting for teaching, learning and research. It is of paramount importance that this provision is constantly visited and re-evaluated, so that our library spaces continue to support the current needs and behaviours of our users. Research conducted by the Futurelib Programme over the last year and a half has challenged our perceptions about what people use different library spaces for, how these spaces function and the role they play in supporting academic work at the University. The Protolib II project has allowed us to apply these insights in a practical way, rethinking the current provision of different types of library space at Cambridge and making viable suggestions as to how this could change for the benefit of our users.

Modern Human were again instrumental in this project, bringing an outside perspective and ways of thinking. They were responsible for the majority of the research design for the project and for the hub-level design. Working together, during this recent work and the original Protolib project, has given us an increased level of confidence in what we have uncovered. We also received support for our work from library staff across the institution, without which we would not have had the capacity to carry out such an in-depth exploration of current activity at the University. The library community in Cambridge has once again proven itself to be capable of great things!
As is always the case with Futurelib research, we have uncovered areas which we are keen to explore further. There is still the question of how professional library expertise relates to the physical library space; how can we translate the interactions our user have with our spaces into meaningful conversations and relationships with our staff? Issues around well-being, social connections and relationships with peers were, as always, a strong theme; to fully understand how this influences their interaction with library spaces and services further work would be needed.

The topology of the University of Cambridge continues to change and evolve; how will developments, at West Cambridge in particular, affect what spaces and facilities will be needed to support our users? What digital technologies will be needed in these spaces in 2, 5, or 10 years’ time? The findings of our research provide a basis for library space design in Cambridge at site, building and individual space level. We believe that much of what we have learned can also be applied to library services beyond the University.

David Marshall
Futurelib Programme
Cambridge University Library
May 2017

Contact Futurelib:
Email: futurelib@lib.cam.ac.uk
Web: http://www.lib.cam.ac.uk/futurelib
Blog: https://futurelib.wordpress.com
Twitter: http://twitter.com/futurelib