Report on "Supporting Lightweight Reflection on Familiar Information" by Aurélien Tabard

From Abigail Sellen (Rapporteur)

This thesis uses in-depth studies of the work of biologists to bring to the fore the important affordances of designing digital tools in order to support their work. Key to this is that the design process needs to consider not just the tools they already have to hand (including both paper and digital tools), but the ways in which they co-opt and adapt them, how they use them as resources and bring them together in that adaptive use, how they make choices about what tools to use and when, and how those choices depend on the properties of the tools. Above all, it calls for an understanding about the nature of the work that biologists engage in.

Here, a key contribution of the thesis is pointing to the idea of reflection as a crucial part of the work that knowledge workers engage in. In other words, the work is important in showing how various tools and artefacts are used by knowledge workers to transform information, which in turn transforms their knowledge. Another important aspect of the research is to show how reflection is an ongoing and crucial part of knowledge work; something that happens not after the fact, but interweaved in artful ways as they carry out their work practices. These concepts are contrasted with more technologically-driven notions that focus on capturing, managing and finding information as the core processes that need to be supported in knowledge workers' tools. In addition, the thesis challenges the notion that data are captured as records of experience. Rather, it proposes that data are captured and transformed by knowledge workers in order to provide the basis for reflective thought.

Alongside these empirical findings, and theoretical explorations, the thesis also describes the iterative design of two digital systems inspired by the fieldwork, and extended through participatory design. These applications are the Prism prototype (or technological probe) – a digital platform which helps integrate data originating both from paper and from the digital world; and also the PageLinker system which provides biologists with ways of connecting important or frequently used web pages together. Taken together, the thesis thus presents us with two strong examples of prototype systems developed from fieldwork, and through user-focused design and evaluation.

I will now offer more specific comments on each chapter, summarising the main contribution of each chapter:

Chapter 1: Introduction

The opening chapter introduces the notion of biologists as special kinds of knowledge workers, and more particularly, knowledge workers who are essentially "lead users" in terms of their willingness to explore and adopt new techniques and methods for their work. This chapter sets this out well with an opening scenario. Here, too, the notion of "reflection" and what this means is then introduced, along with the idea that what knowledge workers already engage in, and need support for, is lightweight reflection. Here, M. Tabard discusses the fact that the fieldwork shows how the tools biologists already have to hand are used in such a way that reflection is interwoven with their activities, and not disruptive of them. This sets the thesis up well to foreshadow the requirements of the design of new digital technologies to augment these practices.

There is also a theoretical contribution introduced here, which is to point out that a focus on reflective practices is different from how PIM tools are usually characterised. That is, PIM tools are often described as tools to help record, manage, maintain and retrieve information. This thesis questions the assumption that information is merely captured. Rather it describes how information is also transformed in the capturing, such as through filtering, processing it and reframing it. In this transformational process, the knowledge of the workers themselves is transformed. It further points out that an important aspect of these processes is that they are performed on familiar information. This further emphasises the fact that it is not the recording of new information, *per se*, which is important here, but rather the reworking and integration of known information which advances knowledge.

Finally, this chapter presents an overview of the rest of the thesis, explaining its constituent parts and setting out how the argument will be developed. All in all, it is a well written and concise opening chapter, clearly outlining the main contributions of the work.

Chapter 2: Related Work

This chapter is a challenging one, since the thesis touches on so many different aspects of biologists' work from issues of memory to note-taking, and from personal reflective activities to collaborative ones. As a result, there are many topics within the HCI literature, from PIM to memory support/ lifelogging, to many aspects of CSCW that are relevant here. Added to this, there are many systems and applications that have been developed which also must be cited, as they relate to the systems designed and developed in the thesis.

This chapter makes a valiant attempt to cover most of these areas, and does a good job of pinpointing some of the seminal and most relevant work across many different areas. It is also well organised, moving as it does from studies of studies of information management to applications to more specific systems for supporting the knowledge workers in question –scientists, and specifically biologists. M. Tabard has presented us with a clear overview of many different areas spanning user research to systems design which sets up the background for the thesis very well.

Chapter 3: Beyond Information Management: Reflection

This chapter further explores the important notion that information management by biologists is not so much about recording information, as it is about producing informational artefacts that enable and support reflection. In its detailed and rich analysis of the use of notebooks and digital tools by 10 people at the Institut Pasteur, it is a significant contribution to the research literature. There is a fascinating corpus of data here and the grounded theory analysis provides an important set of findings on the way in which paper and digital notebook tools are used in different ways. It also provides an interesting assessment of the different affordances of these tools, explaining why the researchers in question move between them. In total, this chapter provides a strong set of observations on an ecosystem of tools, and how these play into the work practices of these scientists. The chapter is insightful and makes a clear case for the central role of reflection. Here a framework for reflection is provided and a description of the processes that biologists undertake. The notion of reflective tools, or "hypomnemata", is also expanded on, which provides a good foundation for the design of the tools described in later chapters. This is nicely summarized in a set of design implications at the end of the chapter.

Chapter 4: Participatory Design of a Hybrid Notebook

This chapter makes an important contribution in describing the design and implementation of a research probe that helps deepen our understanding of biologists' work practices, and also how the design of tools can support the range of practices they engage in. The design process itself was both iterative as well as heavily dependent on the involvement of end users. This is an excellent model for how to develop new tools based on a deep understanding of work practices. There are clearly many different issues and problems that designers face in developing new applications. Some of these have to do with the legacy of data and tools biologists already use, others have to do with entrenched practices, and there are myriad other issues that the fieldwork in the previous chapter began to highlight as well.

Because this chapter describes the design process with a different set of users from those studied in Chapter 3, the research reported here not only connects with the previous set of requirements, but also extends this to focus more on the issue of sharing and integration of information. As this chapter points out, the work practices at INRA are somewhat different from those at the Institut Pasteur. At INRA, project and teamwork, as well as the drawing together of information from distributed tools, represent some of the main challenges. This chapter not only describes the design process, therefore, but offers up a richer set of observations and design implications from a different organizational context. This is nicely summarized by the extended model of reflective practice presented at the end of the chapter.

Chapter 5: Prism and Master Notebooks: A Place for Reflection

Chapter 5 describes the process of developing Prism, a hybrid notebook, using the fieldwork and participatory design workshops as a foundation for its development. This chapter also introduces the important idea of a "master notebook" as a central place in which data can be transformed, brought together and reflected on. Lightweight capture and the bridging of the paper/digital divide are also key goals here.

Five participants used the first version of the probe over the course of several months. Such a long term, in situ, deployment requires quite a robust technological system. After two months of use, some key limitations with the system were identified, and a new design developed on the basis of this. A further long term deployment then offered up new insights in response to two more iterations of the device. All in all, the iterative nature of the design, and the evolution of the system clearly represents a substantial and important contribution both technically, and in terms of user insights.

This chapter confirms the importance of reflection, and presents the challenges of delivering a system which can both meet the requirement to support reflective practices, but also to support many of the other features that are needed in such tools. It is a tall order, but the thesis delivers on this in an impressive way. This chapter also presents more important insights into the ways in which these systems need to be designed in order to support reflection effectively. Here, there are interesting observations made about the ways in which redundancy acts a resource for reflection, and how researchers prefer manual, transformational capture of information to automatic recording.

Chapter 6: PageLinker: Putting Traces in Context

This chapter lays out a good rationale for the need for improved ways of navigating the web, developing a set of tools to do that, and evaluating the system in use. In addition, the description of the ways in which these biologists used the web shows how web use is increasingly diversifying, and this is another contribution of this chapter.

The study finds an interesting set of problems that biologists face when using the web, including lack of transparency, formatting problems, anxiety about unknown methods, problems in refinding, and saving the results of routine actions. These motivate the design of PageLinker. The evaluation study too is well executed using an appropriate quasi-experimental method coupled with a longer term evaluation in situ. The study further introduces the concepts of "implicit interactions" as well as "contextual traces" as important aspects of web search.

Chapter 7: Conclusions and Perspectives

The closing chapter summarises the thesis itself, as well as drawing attention to its contributions. In doing so, it highlights many of the important concepts that have come from the work, including the concept of hypomnemata (tools to support reflection), the concept of a "master notebook", and the need to intelligently capture aspects of interaction implicitly based on a deep understanding of what biologists do. The findings highlight the ways in which information, or data, are transformed, and in turn transform the user. It is not simply a case of filtering or offloading, but to do with the dynamic, adaptive and resourceful use of different tools with different affordances to create a set of resources to create knowledge.

In addition to these theoretical notions deriving from rich observations, there are also the technological contributions, designed with fieldwork and participatory design, and evaluated both in the laboratory and the field. These are reflected on as well, including aspects of their design which link back to the original concepts which inspired them.

Final Assessment

In summary, M. Tabard has produced a first class thesis which more than meets the requirements for the Ph.D. The thesis makes a number of important contributions of a theoretical nature, adding to our understanding of the work practices of knowledge workers through fieldwork. Specifically, it contributes to our understanding of reflection and its central role in knowledge work. More than this, this central part of the argument calls into question some of the assumptions implicit in technological approaches to designing PIM and Lifelogging tools. This is a contribution in itself, yet the work goes on to show how a different focus can lead to new kinds of design implications for tools for knowledge workers. Not only does the research make these clear, but two different prototype systems are built on the basis of these implications. Further these are iteratively evaluated both experimentally and in the wild. The thesis demonstrates M. Tabard's skills and ability not only to conduct fieldwork and laboratory research which gives real insights into users, but also to design, construct and evaluate technological tools that build on those insights.   All in all, this is an excellent thesis.