The Myth of the Paperless Office
Abigail J. Sellen and Richard H. R. Harper

Chapters:

Overview

Ch. 1 – Introduction
Discusses the origins of the myth.
        The phrase 'paperless office' is traced to Xerox PARC, although they trace the idea of replacing paper-based methods of working all the way back to the 1800s with Samual Morse's idea of electronic mail. They mention other precendents for trying to do away with paper, moving forward in time from that early date, including digital libraries and the Internet.

Paper is still around.
        In contrast to the many movements in the past to do away with paper, paper is still an integral medium to our work. To prove this point Sellen and Harper discuss trends in the paper industry: different types of paper (paper grades) used (Table 1.1), consumption of paper across the world (Fig. 1.3), etc. They conclude that rather than getting rid of paper technology has shifted the point at which paper is used doing work.

Why is paper so resilient?
        In the later part of the chapter Sellen and Harper introduce the main question of the book: what are the "affordances" of paper? Technology hasn't replaced paper for a reason. Sellen and Harper will contend that paper is not just a hanger-on from an earlier era, rather paper is still an important medium in work because it is well suited, better suited than many current technologies, for certain tasks. The "affordances of paper … are about what people can do with paper" (p. 17). Most of the rest of the book discusses the results of various ethnographic studies of the use of paper in office work, and in university settings that try to find the affordances of paper. With these studies detailing the affordances of paper Sellen and Harper consider what the respective roles of technology and paper will be in the future.

Ch. 2 – What's Wrong with Paper?
Three problems with paper.
        1. Symbolic
        Paper is a "symbol of the old-fashioned past" (p. 25). The authors give a short story about an employee of a research lab that designs new technologies, this employee

had an office over-run with seemingly disorganized masses of paper. Although the employee was exceptionally efficient, the look of his office struck the wrong symbolic cord with the image of the lab, which was supposed to be on the cutting edge.

2. Cost

The costs of paper documents are problematic after the documents are generated. Printing costs are minimal compared to the start up fees of new technology however after a company has accrued a large mass of paper documents, storage and maintenance is incredibly costly.

3. Interactional

Interactional problems with paper, or limitations on the use of paper include: paper must be used locally, can't be remotely accessed; paper occupies physical space, it must be stored; paper requires physical delivery; one person to one paper document, or the way the document is used changes dramatically; paper documents are hard to revise or integrate into other documents; paper documents are hard to replicate (without technologies for replicating them); and paper documents are static, visual displays (p. 32).

The above problems with paper demonstrate reasons why one might want to eliminate or at least reduce the use of paper.

Going paperless: two case studies

Although there are good reasons for wanting to go paperless, Sellen and Harper review two companies who tried to go paperless to demonstrate that it is a difficult goal that must be motivated by significant organizational changes, rather than a superficial desire to not use paper anymore. One of the companies took the former approach and the other company the latter approach. Guess wich one was successful.

The fact that significant organizational changes must underly a move to a 'paperless' office indicates that paper is needed for certain tasks. Unless the tasks themselves are changed, an attempt to go paperless will not be successful (given present technology).

Ch. 3 – Paper in Knowledge Work
Knowledge work

The term knowledge work denotes a type of work – producing and analyzing information. Harper and Sellen compare the modern day to past generations: "Whereas our grandparents may have worked in factories making anything from ships to textiles, today we are more likely to work in an office where we use our skills to produce and analyze information" (p. 51). For example, my grandma worked in a peach (?) packing plant when she was about my age (or younger), whereas I have built websites or created documents such as this one.

The media with which we store and transmit information are key components to knowledge work and are continually developed. The media include ourselves as cognitive critters, computers of various sorts, and paper documents of various sorts. People and computers are often studied, but little attention has been paid to the affordances of paper. This book tries to fill that lack.

The IMF

The IMF is a mutli-national organization that lends money to countries. Sellen and Harper did a mass ethnographic/other methods study of the knowledge workers of the IMF to see when and how they used paper. (If you are interested in their definition of ethnography see p. 55.) (Sellen and Harper reported the IMF study in [9].)

Sellen and Harper found that paper was used a great deal in the process of knowledge work. For some facts and figures see p. 56 – 59. They include general percentages of use and then break down of tasks. Comparing knowledge workers and administrators shows that there was not a significant difference in the general percentage of the use of paper in overall work but rather a significant difference in the tasks undertaken.

The duo found five general categories of work with documents that paper supported, or people relied on paper during the process of. They write of paper:

1. It **supports authoring work** – although knowledge workers use electronic technologies when they are composing documents, paper is a key part of this process alongside the computer. They may draft documents electronically, but they show an overwhelming need to refer to paper as they do so.
2. Knowledge workers **review documents on paper**, especially their colleagues' work. They read it reflectively on paper, and annotate and comment on it as they do so. They do so despite the fact that they could do this on their computers.
3. When they **plan and think about their projects and activities**, they use pen and paper as the primary means of organizing the work and writing the plans.
4. Paper **supports their collaborative activities**: they sit at conference tables and go through a hard copy of the reports they are working on. They juxtapose sheets of paper and make marks on their documents in the course of their dicsussions.
5. Paper helps knowledge workers **grease the wheels of organizational communication**. Whenever an important document needs to be shared, knowledge workers will print out a hard copy and hand-deliver it themselves to their colleagues rather than send it electronically.

(p. 53, bold mine)

In the previous chapter one of the problems of paper was an interactional problem; paper can only be used locally and must be stored… But the use of paper in collaborative work and organizational communication at the IMF shows that the type of interaction required by paper can also be one of its affordances. The physical artifact provides a means of communication, and the delivery of paper documents is a significant curltural practice.

Something to note about these findings is that they don't concern screen size and resolution as the factors separating paper and computer. Issues of screen resolution are not what interviewees commented on. But those are the issues that many studies have concentrated on when comparing working on paper vs. online. So it is important to note that Sellen and Harper's work is significant in contributing to a different approach to understanding the affordances of paper. They discuss the ease of annotation and juxtaposition of leaves of paper, etc. and mark those as the affordances of paper that cause people to turn to paper over computers. (p. 62)

Beyond the IMF

After discussing paper use at the IMF the authors ask, "Isn't the IMF a very unusual place?" (p. 68). Certainly the IMF does an unusual business, but Sellen and Harper try to show by comparing their study with other studies of offices that the use of paper at the IMF is quite typical. We can hence be secure in taking the IMF study as a representative study of paper use in knowledge work.

Conclusion

The knowledge workers at the IMF continue to use paper for various tasks because paper, and not the technologies they have available, supports the type of work they do. If technology wants to take over from paper, then the affordances of paper that contribute to its persistence must be taken into account. The next chapter looks deeper at reading, an activity involved in all other activities with documents.

Ch. 4 – Reading from Paper
Screen resolution will save us!?

The contrast between this book and studies of screen resolution is especially important for Ch. 4 because advances in screen resolution and displays have been touted as the breakthroughs that will start the rise of reading online and the fall of paper. Sellen and Harper reject this manifesto. Ch. 4 discusses the affordances of paper for reading that go beyond display issues and include the ability to easily and fluidly annotate, manipulate the physical pieces of paper to juxtapose sheets or flip through pages while we concentrate on others.

The language I have just used however suggests that display issues are not very important affordances of paper, which is not the case. They are important. The issue is how important. The affordances that Sellen and Harper discuss are at least as important as screen resolution and other display concerns, and though Sellen and Harper (and I) venture to say that the former are more important this does not invalidate the latter.

Studying reading on paper

To study reading from paper Sellen and Harper conducted a diary study (for a description of what a diary study is see p. 79) with 15 participants. The participants ranged from a pilot to a surgeon to a real estate agent. They call their diary study a study of reading in the real world. After that study they were able to design an informed laboratory study. The laboratory study investigated reading online vs. on paper; the task was to read and then summarize an article, and there was an online condition and a paper condition.

The real world reading study

Sellen and Harper report 8 main results from their real world reading study. Here is a summary of those results given under their respective titles:
1. **The ubiquity of reading.** Reading is ubiquitous.
2. **The preference for paper.** "Paper is the medium of choice for reading, even when the most high-tech technologies are to hand" (p. 81).

3. **Many different kinds of reading.** There are many different kinds of reading such as reading to identify, skimming, and reading to remind. For a full list plus descriptions (10 types) see Figure 4.1, p. 83.
4. **Different ways of reading.** The previous result gave different purposes for reading but there are also many different ways of reading, or interacting with the physical document. Reading a document from start to finish was rare; reading was often a start and stop or flip-here, flip-there affair. Sometimes reading was also collaborative.
5. **Reading in conjunction with writing.** Reading usually co-occurs with writing (over 75% of the time). Writing includes annotation, note taking, form filling, and document creation/modification.
6. **Use of multiple documents.** About half of the time reading involved reading across multiple documents where one or more (up to all) were paper documents. Sellen and Harper give four main reasons for this result: extracting information, integrating information, checking for consistency, critiquing or making comments.
7. **The complex role of technology.** The fact that drives this book, the persistance and importance of paper, can sometimes seem to suggest that only paper is used when paper is used. But Sellen and Harper point out that the tasks are often incredibly complex and although paper is a key medium, it is used in conjunction with technology.
8. **Clusters of readers.** There are many kinds of reading (result 3), but the study results showed a couple of clusters of activities: form fillers, discussants, and cross-referencers.

The laboratory study
        After the real world study Sellen and Harper conducted a laboratory study comparing reading online vs. on paper. They found that readers had four different needs and that these needs were better served by reading on paper than online.
1. **The need for flexible navigation.** Navigating through documents was an important part of reading and then writing a summary; it helped readers plan, check facts, and check understanding. While navigating online was often frustrating and distracted the reader, navigating a paper document was effortless and could be seamlessly integrated with the task of reading.
2. **The need to lay out information in space.** The subjects in the paper condition all spread out the pages of the article in space and cross-referenced different pages for various reasons. Sellen and Harper also noted that readers used two hands to manipulate and rearrange the physical document. Again subjects in the online condition were frustrated by their limited ability to rearrange a document.
3. **The need to annotate while reading.** "Paper readers extensively annotated the article" (p. 95). "In contrast, readers who were given only a computer to work with voiced frustration at not being able to annotate the document in some way" (p. 96).
4. **The need to interweave.** Subjects interweaved reading the article and writing (note taking) on separate pages. Again subjects in the paper condition had a much easier time than subjects in the online condition. Results 1 and 2 above influence this result.

Conclusion

The findings of the real world reading study "challenge the conventional view of reading that says that people read documents one at a time, that people read from the beginning of a document to the end, that they read by themselves, and that they do *not* do other things (such as writing or annotation) at the same time" (p. 100-101). The results of the laboratory study help explain how paper supports the real-world reading activities.

The future of electronic reading

In this section Sellen and Harper overview the possibilities for digital reading devices. They are not positive for the prospects of liesure devices but other digital reading devices they think will increase in popularity as long as their designers take into account the affordances of paper. In order for digital liesure books to do the same research into the use of paper liesure books must be undertaken.

Ch. 5 – Paper in Support of Working Together

The IMF study showed that paper was almost always used when collaborative work was being done. This chapter presents the results of three further investigations into the use of paper in collaborative work. Sellen and Harper try to show how paper aids collobaration, they do not necessarily advocate that paper "is always the best medium for collaborative work" (p. 108); it depends on the situation.

Paper in air traffic control

The paper artifact focused on here is the flight strip. Sellen and Harper conclude that unless the need for collaboration were reduced by a reorganization of the structure of airtraffic control procedure, it would be very hard to come up with a better device than the paper flight strip.

Paper in police work

In the polic work case paper was better suited because the current technology did not facilitate the interaction between police officers and citizens that was necessary. Police officers were given laptops to fill out incident reports with, however they had to focus on the laptop and fuss with it rather than focus on the victim. This caused the person with the complaint to become more and more distraught because the officer was occupied with the computer rather than them. The order of the form was also not the order the victim recounted the story in, nor could the form be completed at one time due to the nature of crime reporting, which unfolds over time. The problems in this situation suggest that improvements in technology sensitive to the characteristics of the task are needed and with such improvements switching to technology would probably be successful.

Paper in a chocolate-manufacturing company

This case looks at "the sharing and archiving of organizational information" (p. 123), or filing systems for paper documents. Sellen and Harper discuss that there are different types of paper filing systems and some would be very difficult to replace with a digital alternative while others could be switched to electronic files.

The take home message of this chapter is that if a company is trying to replace paper with digital technology it must understand its organization and paper use in order to assess where and how such a move would be successful.

Ch. 6 – Designing New Technologies

In this chapter Sellen and Harper advocated viewing paper as an analytical resource for the design of technologies rather than as a problem. As an analytic resource paper helps us to understand organizational structure and the role of document technologies, why paper is often used over technology, and helps guide us in "choosing, designing, or developing new kinds of products, systems, and services" (p. 141).

Do electronic devices need to copy paper? Sellen and Harper say no. The affordances of paper should be understood under the larger goals they serve and achieving these goals should be the aim of technology. (p. 142)

Using paper as an analytic resource Sellen and Harper take a look at document-reading technologies and DMSs (Document Management Systems). See Table 6.1 (p. 150) for a list of the affordances of paper and the affordances of digital technologies for reading. See Table 6.2 (p. 173) for a list of the affordances of paper and the affordances of DMSs for document sharing and management.

Ch. 7 – The Future of Paper

In this, the final chapter of the book, Sellen and Harper ask the question: what will be "the role of paper in the office of the future?" (p. 185). They discuss this question by looking at "three kinds of reasons that people stick with paper despite the burgeoning of digital devices" (p. 186).   First, the coevolution of paper and work practices means that serious reductions in the use of paper cannot be undertaken successfully without seriously reorganizing the work practice. Second, the digital alternatives to paper need to be better designed. Until that happens, until paper is used as an analytical resource for the design of technologies, paper will almost certainly continue to be the medium of choice. And third, the affordances of paper indicate that even if well designed digital technologies are to hand paper sometimes "works so well for some of the jobs it is called upon to do" (p. 200). This indicates that even if/when digital technologies increase in number and usefullness paper will most likely still be found around the office.

Extra References
(References are from my project, so they mostly focus on annotation, but the issue of paper is predominant. Also includes some of the case studies Sellen and Harper write about in their book.)
(An overview of these papers is in my honors paper, as they relate to my project of course. Follow the link on http://hci.ucsd.edu/lecampbe/lauren.html to see my paper in PDF form.)

(These are all available online (even if the title isn't a link here). To find them either do a search for Abigail Sellen or Catherine Marshall, each has a page with links to their various publications.)

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