Saving and Using Encountered Information: Implications for Electronic Periodicals

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ABSTRACT
As part of a focus on electronic publications, we undertook an exploratory study of how people saved and used the information they encountered while reading. In particular, we wanted to understand the role of clipping and whether it would be a necessary form of interaction with electronic publications. We interviewed 20 diverse individuals at home and at work, bringing together narrative accounts and physical and digital examples to investigate how people currently collect and use clippings from their everyday reading. All study participants had examples of materials they had deliberately saved from periodicals, ranging from ads torn from newspapers and URLs received in email messages to large stacks of magazines. Participants rarely read periodicals specifically to clip but rather recognized items of interest when they were encountered. The work highlights the importance of encountering information as an activity distinct from task-focused browsing and searching and reveals design implications for online reading and clipping technologies.

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Reading, clipping, field study, digital libraries, electronic publications, design.

ACM Classification Keywords
H5.2. User Interfaces; H3.7. Digital Libraries.

INTRODUCTION
Increasingly, people are reading periodicals such as newspapers, newsletters, catalogs, and magazines online. As reading practices shift to accommodate emerging forms of electronic periodicals, new technologies such as e-book software, reading environments, and tablet computers are being developed to support reading on the screen [7,12,23]. Given these trends, it is important for the design community to understand which characteristics of reading on paper should be preserved, and which can be supplanted by new kinds of interaction and functionality [1,17,19,20].

With this issue in mind, we began an exploration of how people clip, save, and expect to use material from the paper and electronic publications they read today. The study was one phase in informing the design of intuitive ways of interacting with electronic publications, in which clipping is part of a larger set of reading-related interactions such as annotation and triage. To this end, we define *clipping* as *intentionally saving portions of published material.*

Prior to this study, we had informally observed clipping from paper periodicals in many everyday situations: on airplanes, in waiting rooms, in offices, and at home people rip items of interest out of magazines and newspapers and tuck them away in briefcases, leave them out on tables, or put them in heterogeneous piles and files.

Clipping also appeared to be an important way of interacting with digital media. People clip articles of interest (or URLs referring to the articles) from online news sources and send them to colleagues and friends. They also save them so they can be consulted later. Much like they do in the physical world, the digital clippings and references amass here and there, in bookmark lists, in files, and in email folders, and may be used again or not.

The major questions that drove the research directions for the study we describe in this paper include: Is it necessary to explicitly save clippings in an age of searchable electronic publications and archives? If so, what would make electronic clippings more useful and easier to manage? What are the barriers to effective use of encountered information and what are the implications of these barriers? Our findings answered these questions and suggested that we think more deeply about the role of encountered information in our everyday lives and in online interfaces.

This paper is organized as follows. First we situate the study within the related work. Then we describe the study, its participants, and the data we collected. We present our findings according to the questions we were trying to answer with the study. We conclude by discussing not only design implications for electronic periodicals but some implications of interacting with encountered information.

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RELATED WORK

Our work follows in the computer-human interaction tradition of using fieldwork findings to inform the design of new technologies (e.g., [3,4]). This study also builds on three different areas of related work: (1) field studies of reading and interaction; (2) the design of new technologies for reading and interacting with digital documents; (3) studies of discovering and using information.

General studies of reading in the field have aimed at creating a taxonomy of types of reading and a more extensive understanding of the characteristics of the practice [1]; these studies extend and complement what is offered by earlier laboratory studies (e.g. [8]) or cognitive models (e.g. [14]). Most specifically, these studies of reading have led to a more nuanced sense of how people interact with materials as they read [17,19,20]. Clipping is a fundamental mode of interaction with periodicals that is comparable to other reading-related interactions like annotating, gathering, and triage that have been the focus of previous studies [24] and an outcome of investigations into the affordances of paper [25]. However, unlike other forms of reading-related interaction, clipping tends to be more opportunistic and less task-related, and is thus a particularly relevant way of interacting with magazines and newspapers. Our contribution in this area is to extend the understanding of how people interact with their reading materials when there is not a well-defined motivating task.

Other related work has been focused on creating an appropriate technological environment for reading. Pen tablet computers provide a mobile platform for reading and offer paper-like interaction [23]. Further work has investigated how the artifacts of reading (e.g. annotations or records of paths through documents) may be used to support reading-related activities and go beyond paper [17,22]. Our contribution in this area is to establish the relevance of clipping technology in electronic periodicals and to suggest directions for developing such technology.

The third area of related work comes from the intersection of human-computer interaction with library and information science. Much of the focus of interface design in this area has been on query-driven information-seeking [21] or on metadata-based browsing of a coherent collection (for example [30]). Yet information encountering has been identified as an important way in which people discover new material [10]. Other work in this area has been in Personal Information Management (PIM) and how people organize and manage an incoming flow of items [5]. Our contribution in this area is to extend the understanding of encountered information and its uses to form an improved basis for the design of interfaces to digital libraries, bookstores, and online archives and to extend PIM research by noting problems introduced by encountered information.

STUDY DESCRIPTION

To understand how people clip items from periodicals, we felt it necessary to take into account both the ubiquity of the practice and the different genres of periodicals available today in paper and digital form. Thus, the study was organized around a number of short field visits in as many different kinds of sites as possible, both homes and offices. This initial study was designed to be broad rather than deep, bringing together narrative accounts and physical examples to investigate the ways in which people currently collect and use clippings as part of their normal reading activity.

The study consisted of a 20-participant series of artifact interviews in homes and offices, divided between two different U.S. cities and the surrounding areas. The intent was to be in locations where people receive and read periodicals and thus have an opportunity for clipping. The interviews were open-ended with probes for observing actual examples as located in the home or office.

Participants were selected across a broad range to ensure that we would understand whether or not clipping might be specific to age, gender, or occupation. Half were male and half female; ten of the interviews were in homes and ten in offices. One participant was interviewed both at her business and in her home. We oriented toward younger, high income, college educated participants as the group most likely not to clip in traditional ways, although we included participants across a range of ages (16 to over 65) and a large variety of occupations and education levels. Table 1 details the individual participants.

Participants were told that subscribing to and reading periodicals was the study's focus to avoid any attempts at guessing what we wanted to hear. Although online reading was not a requirement, we ensured that all participants used computers and accessed information from the Web at least a few times a month with at least one participant in each city who regularly read online publications. During the interviews, we determined that at least 12 out of the 20 participants read online periodicals, and only 2 were infrequent computer users.

Working together, we spent 60-90 minutes with each participant to inquire into their periodical reading, to probe for whether or not they ever saved anything from their reading (i.e. clippings) and, if so, how, and to ask them to show us places where they saved or might save such material, both on their computers and in their physical files.

DATA

At each interview site, we recorded examples of clippings, moving around the participant's home or office as necessary to find material or publications they had purposefully saved. Each clipping or file of clippings usually elicited a story about why the participant had saved the clipping and what he or she had hoped to use it for later. We were interested in discovering the variety of forms these clippings take and functions they serve.

Our data consisted of audiotapes of the interviews, pictures of the example clippings and where they were kept, written notes from the interviews, and debrief comments on each

ID	Participant's profession	Gender	Interview location	# clipping examples	Work / Personal		Physical / Digital / Both		
P1	Unemployed Teacher	F	Home	22	6	16	16	4	2
P6	High school student	F	Home	19	0	19	13	6	0
P10	Environmental scientist	F	Home	25	0	25	21	4	0
P14	Homemaker	F	Home	16	0	16	12	4	0
P15	Secretary	F	Home	20	0	20	17	2	1
P2	IT director	M	Home	23	11	12	15	7	1
P7	Business services	M	Home	12	2	10	10	2	0
P11	Senior sales manager	M	Home	28	6	22	20	7	1
P13	Army reservist	M	Home	16	0	16	11	4	1
P18	Owner, wholesale nursery	F	Both	20	7	12	16	4	0
P5	Office administrator	F	Work	13	8	5	10	2	1
P9	Public relations	F	Work	9	8	1	4	5	0
P12	Executive assistant	F	Work	18	7	11	11	7	0
P20	Museum content designer	F	Work	18	16	2	9	8	1
P3	IT manager	M	Work	12	10	2	4	6	2
P4	Environmental outreach	M	Work	22	22	0	16	4	2
P8	Individual consultant	M	Work	18	16	2	12	6	0
P16	Partner, design firm	M	Work	15	12	2	7	6	1
P17	Partner, retail nursery	M	Work	14	14	0	12	1	0
P19	Financial advisor	M	Work	10	10	0	5	3	2
total				**350**	**155**	**193**	**241**	**92**	**15**

Table 1. Summary of the study participants and the clipping stories, examples, files, and caches collected from each

participant's session. We extracted and organized the examples from the notes into two collection files, one of general types of clippings and the other of issues related to clipping. Examples in the collections were clustered to allow categories to emerge directly from the data [18].

Each of our participants had material evidence of some sort of clipping practice. Table 1 summarizes this data. We include counts to indicate how many separate accounts, vignettes, files, or individual examples we observed at each interview site; the count does not reflect the literal number of examples we saw. In some instances, files, folders, or drawers contained a large number of individual clippings, such as recipe folders, project information notebooks, or "travel ideas" files. In fact, almost half of the instances in Table 1 represented cases in which multiple clippings were observed. Although we interviewed people at either home or work, it was evident (and unsurprising) that many people clip personal material at work, and encounter work-related material at home. Two of our examples did not fall clearly into either work or personal clippings; these were heterogeneous files or piles of clippings.

While our study emphasized physical clippings, all of our participants showed us examples of digital clippings too. More than half of the participants had at least one example of a case in which they had a physical and digital form of the "same" clipping. That is, they had retrieved an online version of a physical clipping or vice-versa, usually to make sure they were actually the same, to make transmission easier, or because they found the physical artifact to be more authoritative than the digital version. See the "both" column of Table 1.

Despite stereotypes we encountered before we engaged in this study, clipping does not seem to be associated with gender or age, nor does it seem to be a specifically home-related or work-related practice.

In as many cases as possible, we documented participants' accounts of their clipping practices with short vignettes describing the use of the clipping (in the participant's terms), and if possible, a digital photo of the clipping or the cache of clippings. Figure 1 shows two examples of clipping vignettes and photos.

ANALYSIS

Using our collections of examples, we based our exploration of the data on our three driving questions. To consider whether clippings are still necessary in electronic publications, we focused particularly on the value or function of the clippings to people. To understand what would make electronic clippings useful and easy to manage, we looked at how participants saved clippings (their form)

P2's siblings send him electronic clippings in email when one of their kids appears in the local newspaper, e.g. as a member of a sports team. When P2 gets a clipping like that, he files it into an email folder. When his nephew was in a football team picture, he saved the picture from the online article in his default Pictures folder.

(a) Example of clipping at home

P20, a museum exhibit designer, cut out an article from the Sunday edition of the local newspaper on the future of museums. She brought it in to work and posted on one of her bulletin boards: "With that it's just a reminder of the integration of technology. I try to keep that in mind as we're doing projects."

(b) Example of clipping at work

Figure 1. Physical and digital clippings at home and at work

as well as the duration they were useful. Finally, we looked at the barriers to effective clipping and the implications for technology design.

Why people clip

Participants clipped and saved published materials for a variety of reasons. Intuitively, we might think of clippings as providing reference information that is either potentially useful (e.g. recipes or "100 Best Restaurants") or specific (e.g. a file on autism). However, often clippings were saved for other reasons: as reminders for action (e.g. ads or catalog entries for items to be purchased later), to evoke memories (e.g. the front page from 9/11/2001 or a friend's appearance in a popular magazine), or to share with a friend or colleague (e.g. clippings that are passed around the workplace when the company appears in the popular press). Some were saved simply because the participant hadn't finished reading the material (e.g. a stack of unread material by the bed; printouts of web pages; a magazine article). Figure 2 illustrates relative prominence of the major functions of clippings.

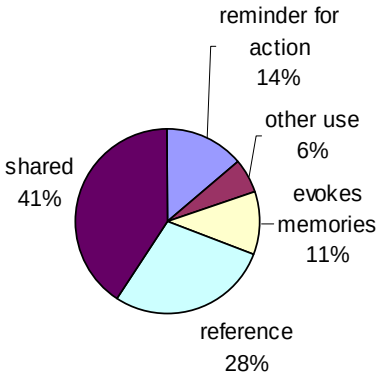


Figure 2. Relative prominence of primary clipping functions

No function was limited to either personal or work-related items (although the clippings that evoked memories tended to be personal). Nor could clippings be unambiguously categorized according to function. In practice, many clippings served more than one purpose or the clipping's function changed over time; a clipping that served as a reminder to buy a ticket to a show might turn into an evocative artifact that brings to mind pleasant or significant memories. A recipe used for reference when dinner is being prepared might have served as a shopping list earlier in the day. This ambiguity does not detract from the observation that clippings served different important functions to the study participants.

Useful or potentially useful reference material

Over a quarter of the clippings we documented were saved because they were of immediate value or identified as containing potentially useful information; each participant showed us one or more clippings of this type. This category includes material that was saved for long-term reference, such as recipes, medical information, "how-to" tips, and other information that participants encountered and thought might come in handy at some later date. Other reference information that participants saved was of immediate use – the address of an art gallery, material for a specific project, press clippings, or product information.

> P18, a commercial nursery owner, hopes to build a new house and has saved a large box with magazines and clippings of house plans and decorating hints. She described it to us, "What I have here are just pictures of ideas." She doesn't plan look at the clippings again until she has settled into a new house. But she told us that the box will be there when she's ready to use the materials she has saved: "I'll have this stuff."

Reminder for action

Almost fifteen percent of the clipping examples that we discovered during the interviews were reminders for action. This is a relatively common use for clippings: sixteen of the twenty study participants showed us examples of clippings they had used in this way. Most of the actions the participants described were specific and limited: purchasing goods or tickets or attending an event.

> P6, a high school student, has a recipe for "Cincinnati Chili" clipped to the refrigerator door (see Figure 3). She says her dad originally cut it out and put it in the recipe box some time ago, but that he'd pulled it out because "he's going to make it this week." This is a clipping that spans categories; it is not just a reference (when it is in the recipe box with the recipe collection) and a reminder for action (when it's on the refrigerator door); it is also a shared clipping, because P6's father has used it to communicate his dinner plans to P6.

Figure 3. A recipe clipping currently acts as a reminder for action, but also serves as a reference and shared awareness.

Evoking memories

At least ten percent of the clipping examples had been kept for their evocative qualities. Twelve of our participants showed us clippings of this sort. Most of the examples were personal; the few cases that were work-related were retained as institutional memory.

> P10, an environmental engineer, has kept a copy of *Highlife* magazine and a program for a cannabis festival in Amsterdam ("where everything's allowed") to remind her of a European trip she took by herself in 1995. She intends to keep the magazine – which she purchased – as well as the program for the festival: "That's a long time ago. I'll probably keep [the magazine and program] because it was an experience I had and I want to remember it… I feel silly that I kept it… I really do like Amsterdam. It's one of my favorite places in the world."

Sharing

Sharing represented a very significant role for clippings; between one-third and one-half of the saved material that we saw had been shared or was destined to be shared. Each of the study participants had acted as a giver and a receiver of clippings at some time and the sharing took place both at home and at work. Both physical and digital clippings were shared. Because sharing was such a widespread use of clippings, our first detailed analysis of the data, reported in [16], covered this practice in depth.

Shared material played a very different role than the clippings the study participants kept for themselves; the information in these clippings was subsumed by overarching social imperatives such as keeping in touch, establishing rapport, creating shared awareness, or educating. These clippings were less likely to be kept for a long time by the recipient or valued for their informational content.

> P8, an individual consultant for an investment firm, reads the *Wall Street Journal* and the *New York Times* several times a week to see if his company is mentioned: "Those are two papers our company shows up in a lot, so usually we get an email that says, 'hey. We're listed today. Check out the article.'" An assistant found the story online and printed it out for everyone in the office. In this case, the article was used to create shared awareness: it was important for the employees who came in contact with customers to know what the customers had seen in the press.

> P6, a high school student, receives links to online articles from her dad sometimes as often as 2 or 3 times a day. She usually reads the articles on the screen but doesn't keep them. For example, her dad had sent her an article from the *New York Times* comparing the war in Afghanistan to Vietnam. "Sending me the article is like a little note… I don't know why we starting doing that, but it's a habit now. And it's nice to feel like someone's thinking about you. It's his way of saying 'hello' during the day."

How people clip

As we interviewed the participants, we observed that clippings are saved in a great number of forms. These include photos and schedules taken out of context from longer articles, neatly clipped articles, scraps of paper, entire pages ripped from magazines, newspaper sections, and URLs that refer to specific items in an online periodical. Some participants even saved whole magazines.

Figure 4. Forms varied from small cuttings to full magazines.

In Figure 1a we refer to a photo saved out of context; the participant only cared about the photo of his nephew, not about the account of the event, since the boy was not mentioned by name in the article's text. On the other hand, some participants saved whole pages or sections to provide more context than the clipping alone offered; others carefully limited the scope of a clipping to the article itself. While saving a whole periodical for a specific item in it was less common than clipping out the desired portion, almost every participant showed us examples of this practice.

How long participants intended to keep clippings varied as well. Generally duration was not associated with the type of clipping (e.g. a reference) so much as why it was saved (e.g. information for planned travel). For example, many reference clippings were kept indefinitely but some were transient.

> Figure 5 shows a printout of an article about antioxidants that P5 plans to check against her current multi-vitamin regimen because she is "curious to see if we [she and her husband] were on the right track."

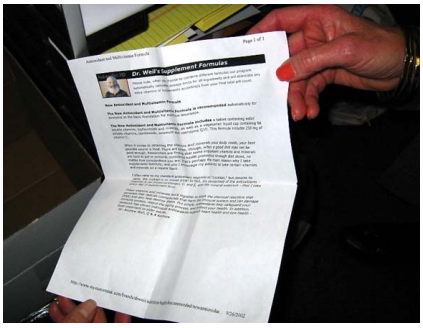


Figure 5. A reference clipping of limited lifespan

Also common were clippings that were viewed as useful for an undefined, but also limited, period of time. It was not unusual for these clippings to be discovered in stacks and files long after their potential utility had passed.

> P19, a financial advisor, has a photocopy of a one-page *Business Week* article in his files; the article compares his company to a competitor. P19 thinks it was probably distributed throughout the office at the time it appeared. He had highlighted a few sentences that talked about job cuts and changes in strategic thinking. He says that he "didn't even know it was in there [his files]. Surprise, surprise." After he sees it, he described it as "not particularly useful" anymore.

Just as some clippings were clearly time-sensitive, study participants planned to keep and use others indefinitely. Some, like recipes, were regarded as valuable for reference for an indefinite period of time; most of our home-based interviews revealed large caches of clipped recipes that had been accumulated over a long period and would be kept for a long period. Similarly, participants showed us files of clipped reference material on topics central to their lives.

> P15, a secretary, has an autistic son; she and her husband have accumulated a large file of clippings about autism that they save, consult, and share with others. "See, these are things we keep for long periods of time."

Participants also saved clippings that had a less obvious long-term purpose, but were viewed as personally or professionally important. These clippings were sometimes described as sources of ideas or inspirations for future projects.

Finally, study participants interviewed at home frequently had clippings they said they would keep "forever." These clippings generally fell into the category of memory-evoking material. They were sometimes tucked away for safekeeping, with the idea that it would be interesting to look at them again when the participant was much older.

Barriers to Effective Use

Because one motivation for the study was to identify barriers to effective use, we collected accounts of how and whether a particular clipping was used. Sometimes we heard success stories – how a clipping had been used as intended (to remind, to stir memories, or as a reference). We also discovered common phenomena that represented obstacles to effective use. Recurrent themes were:

- Clippings that were remembered but could not be found again when they were needed;
- Clippings that had been forgotten and were then rediscovered when they were no longer useful;
- Articulated strategies for staging a re-encounter with the clipping, both ineffective and effective;
- The desire to keep materials organized and culled, to avoid being thought of as a "pack rat"; and
- The ability to recover context (and intended use) and to establish an item's authority via metadata.

The first four of these phenomena arise because the practice of clipping and saving clippings was often associated with information the participants encountered rather than searched for outright. Thus it was harder for participants to manage the clippings, and it was far easier for the information to fall between the cracks. The last one has to do with how clippings are often extracted from their original complete publication, and how context and authority must be reconstructed on-the-fly.

Failure to find saved clippings

Almost half of the study participants recounted a specific situation in which they had remembered a particular clipping they had saved (or intended to save), but were unable to locate it when the time came to use it.

> P17, a partner in a retail nursery, remembers a good article on poinsettias that described the colors in a way that the availability list from a grower did not; the availability list just had the names of the different varieties. "I couldn't quite visualize it, because there are 50 different shades of red. I knew I had seen one in a magazine. But after looking through about 50 [of his saved magazines], I gave up."

In line with the findings presented by Jones et al. [13], participants also lost electronic clippings. For example, sometimes participants saved references to articles, which had subsequently disappeared or were not returned by recreating a search. This phenomenon is the one addressed by search technology that handles re-finding familiar resources such as Stuff I've Seen [9].

Forgotten clippings

It was very common for participants to forget they even had particular clippings; almost all of the study participants were surprised at least once during the interview by a clipping that turned up in their files.

> P19, a financial advisor, has an article in his files from the *San Francisco Chronicle* dated February 28, 2000 that he had received by fax. Not only does he not remember reading it ("I don't think I've ever read it.") but he also doesn't know why he kept it.

We also discovered misfiled clippings, and clippings that were unfamiliar to the participant until he or she re-read

them and realized why they had been saved. More interesting were the clippings saved *in situ* (that is, not torn out, but rather saved in place), but then the participant failed to remember *why* the whole publication was saved.

Strategies for re-encountering needed information

Participants recounted a variety of strategies for coming upon the information they had saved when they expected to need it. All but one of the study participants had accounts of at least one strategy they used for re-encountering clippings when they were needed.

If the clipping was to act as a reminder for action (one of the categories we described earlier), it might be posted in a place that the participant used for this purpose (like a refrigerator door at home or a cubicle wall at work). It might also be left in plain sight on a horizontal surface in some central or frequently-used location (such as a work table, a bed, or a countertop).

> Both P7 and P10 clip football schedules as reminders or references. P10 taped hers to the kitchen cabinet to remember when the games were, and P10 left his on a table by his easy chair to remind him of his bets on the football pool. Figure 6 shows both clippings.

Reminders for action may also be carried in a briefcase or purse so they can be re-encountered in the appropriate situation or place (at a store or taken from work to home).

To facilitate re-encountering a reference clipping, it might be filed with topically similar material (such as a travel folder or a project stack).

> P15 has an envelope with information she is saving for an upcoming trip to Hawaii; she also has a travel section she had saved from the Sunday newspaper from which she plans to cut out certain items and add them to the envelope.

Re-encountering strategies were more limited when they were applied to digital clippings. Some were printed out and handled the same way as physical clippings. But also, to keep digital clippings in mind, participants used bookmarks, topical folders, or simply hoped they could remember to search for them. Participants regarded the ability to find what they had saved as a substantial and sometimes insurmountable risk.

Desire for organization

Most of the study participants expressed a desire to keep their stuff organized and culled; it was important to them to avoid being a "pack rat" (at least a quarter of our participants used precisely this term to refer to their own behavior). This desire for organization appeared in several different ways. Some participants were reluctant to keep information they had found (although material evidence suggests that they usually overcame this reluctance); others said they purged their files periodically or filed lots of stuff at once, comparable to Whittaker and Sidner's observations of how people manage their email [28].

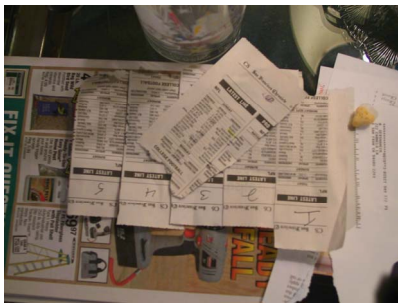
> P16, a partner in a design firm, says: "I rarely keep anything… Mainly because I've just proven to myself that they just go sit in a folder and I never look at them again. So I try to grab as much as I can out of it and continue on… The thing is, I'll read something that's in front of me. Like, I'm opportunistic. If I have the time, and the article comes that makes sense – whether it's sent via link, I find it online, it comes in a magazine – then I'm done with it at that point…."

This account of his own behavior was contradicted to some extent by the participant's overflowing desk, but it was a general sentiment articulated by others as well. Study participants also noted that they expected to be able to find the same material again if it was online, and that paper periodicals (especially special interest magazines like *Shape*, a fitness magazine, or *Outside*, a camping magazine) published articles that contained essentially the same information every few years.

Metadata and reconstructing context

Because participants often forgot they had saved clippings, they needed to reconstruct context to remember the clipping's intended use. People would reconstruct context in a variety of ways: through the clipping's intrinsic metadata (e.g. the publication name or date), though the memory jogging properties of its visual appearance (e.g. the shape of clipping or the age of the paper, reflected in how it had deteriorated or even a publication's recognizable typeface), or through their own interaction with the clipping (e.g. their annotations or where they had left the clipping). Equally important was where the person got the clipping and why he or she had saved it. In other words, the content

(a) P10's football schedule taped to the kitchen cabinet



(b) P7's football schedule on the living room table

Figure 6. Two similar reminders for action, left out and visible in two different ways

itself did not stand alone;

> P16 comes upon a Web printout that he doesn't remember. He recalls that it came from the technical director because the headline referred to "business intelligence." Some notes he had made on the back of the page caused him to remember that the technical director had presented it at a board meeting and that they had gone through it as a group. Eventually he reconstructs the context, "I guess I had just digested it." He feels there is no long term value in the notes he had taken other than allowing him to reconstruct the context in this way.

In addition to allowing the participant to reconstruct the clipping context, metadata such as source also had bearing on the item's authority. Several of the study participants had laminated clippings (or had them printed as glossies) to use as authoritative sources to share with their customers.

IMPLICATIONS FOR TECHNOLOGY DESIGN

Our analysis indicates that clippings will continue to be important in an age of electronic periodicals because they represent such a broad range of personal information behaviors and collaborative uses of material. Electronic clipping technology should provide the ability to clip articles and article components, retaining the desired amount of scope and intrinsic metadata, while avoiding the interruption of any primary activity such as reading. Once the desired material has been excerpted from a publication, clipping functionality should provide a basic service to archive and share saved material flexibly. While this initial exploration was not intended to produce specific technology designs, the study suggests several technology opportunities:

Accessible personal archives for storing the many forms of material that people clip. Archives may be developed to store whole e-publications, e-clippings, web pages, and excerpts that retain appropriate metadata to enable source traceability. Electronic clippings with long-term value might be part of a heterogeneous lifetime archive (e.g. [2]) and certainly should be part of any personal digital preservation efforts; clippings with more limited utility or value may fall into the purview of cross-application PIM tools, such as those suggested by [5].

A variety of collaborative tools (e.g. [6]) may be extended to take advantage of the social roles of clippings. Our analysis reveals the importance of sharing, but Erdelez and Rioux's studies show that even the most straightforward clipping and sharing facilities are not used for a number of good reasons (e.g. the need to have the recipient's email address at hand or the worry about whether advertising will be included) [11]. Furthermore, clippings are shared in ways and for reasons that aren't addressed by a simple service (for example, clippings may be handed directly to the recipient as an impetus for conversation or clippings may be left in the break room or tacked to a bulletin board for awareness). From a social perspective, we should attend to how sharing this sort of material contributes to the strength of social ties outside of traditional information exchange [16].

Functionality beyond searching and information needs-directed browsing can support the re-encounter of saved information. This type of functionality will be necessary given the problems our participants had remembering they had saved a clipping. While the development of techniques for searching familiar material is a good start [9], it will also be necessary to redesign the familiar user interface substantially to support the ability to re-encounter clippings, either from the standpoint of "leaving them out", as many of our participants did when there was an appropriate physical surface to do so, or from the standpoint of allowing them to come upon things they have saved from time to time, to jog their memories. We discuss this further in the next subsection.

User interfaces need to support secondary interactions like clipping without interrupting primary activities like reading. Digital clipping must be intertwined with reading on the screen, in much the same way as pen tablet software like XLibris supported unselfconscious annotation of digital materials [23]. People don't set out to clip out the information that they encounter serendipitously when they read periodicals. Instead, they save interesting or important items as they see them. The barrier to clipping must be low; otherwise it significantly interrupts reading. Participants told us stories of material they had failed to clip because it was too much trouble. As Levy observes in [15], we should be aware that new technologies can cause further fragmentation of a reader's already scarce attention.

Significance of encounter and re-encounter

The study results transcend specific design implications to highlight a broader set of HCI issues stemming from the role of electronic periodicals in current models of information behaviors (e.g. [21]). That is, clippings represent information that is most often *encountered* in the act of doing something else (e.g. reading) rather than information that is actively sought. Encountering information while otherwise engaged is an important counterpart to engaging directly in browsing and searching (see [10]). Encountering information can facilitate serendipitous discovery or foster creativity (e.g. [26]). It is a fundamental vehicle for the transmission of ideas within a community [29], and may help strengthen social ties [16,27].

Because encountered information is so different from information that is deliberately sought, it is important to keep it in mind when we create digital resources and the attendant functionality and interfaces. Some of today's trends work against encountering by zeroing in on very specific information needs: personalized newspapers, niche publications, and effective search engines such as Google. This is not to denigrate these trends; they are necessary in a surfeit of digital resources – we need to be able to find what we need to do our work or to engage in a variety of task-

specific activities where we want to have information at our fingertips. On the other hand, we don't want to lose sight of what we have discovered or learned from our everyday reading.

Similarly, because encountered information is often not associated with a specific task or information need, it is easy to lose it, to not see it again when it could have been useful. Earlier we discussed how people have strategies for re-encountering what they have clipped and saved, but we saw that these strategies weren't always sufficient. Just as the initial encounter is important, it is also important to facilitate means to re-encounter information.

Design implications of encountered information

Though the notion of encountered information is not new, clippings provide an apt example of the phenomenon, and the study results underscore ways in which this encountered information is useful. Many existing tools and interfaces are developed from a perspective which assumes that information is sought when it is needed or collected for a task that is underway. But this perspective may conceal how people discover new things or use material they have found without a specific need in mind. This perspective also conceals difficulties people have in using the encountered material later in the ways they had originally intended.

Thus, there are broad questions about providing venues for encounter and re-encounter. First there is the form of the periodical itself. Online periodicals have a long way to go to match the affordances of their physical counterparts. E-magazine providers (see, e.g., Zinio, http://www.zinio.com) capture the familiar look and layout of popular magazines and research projects such as [7] have focused on careful simulations of page-turning, but casual navigation – for example, flipping through a magazine – has not been duplicated. Electronic newspaper services (for example, the *New York Times* online) give a reader today's headlines, but not the same quick grasp of the news that the physical newspaper delivers. The experience of reading a physical periodical remains different than the experience of reading a digital one; encounter is facilitated by physical form since the reader tends to notice much more than the headline at a glance (the length and position of an article, for example, or the details of a photo).

> P5, an office administrator, realizes that she notices different things in physical and electronic forms: "I see it [a trade magazine, *Meetings and Conventions*] two ways. I'm not so clever that I say, 'oh wait a minute. I already read this at my desk.' I'll look again. If I get it online, I'll look at the topics, and I'll think, 'oh yeah. That was kind of interesting.' Because sometimes you're really in a hurry, and you won't give attention to one or the other, whether it's hardcopy or on the screen."

This difference is amplified by physical venues for encounter like newsstands. While electronic archives are well-suited to effective searching, newsstands and library reading rooms are geared toward encounter – they are designed so the reader has the potential to encounter a wide array of magazines and their constituent articles, photos, advertising, cartoons, and other content.

Thus we need to develop interfaces that take "encounter" into account; we don't always read with information needs in mind. Flipping quickly through a magazine, walking into a newsstand, or looking a little further down the shelves in a library brings us into casual contact with interesting content we wouldn't otherwise see.

Second, once information is encountered and saved, our current interfaces make it easy to forget what we have saved, and in fact, never to see it again. Our physical strategies for re-encounter are more finely honed, and take into account the surfaces and places in our homes and offices, and not just more formal organizing tools like file cabinets, cubbyholes, or notebooks. Even though many computer tools support informal organizing methods like piles and lists, they are still task- or topic-oriented and often don't provide the differentiated geography that allows us to leave something like a clipping in our path.

CONCLUSION

On the whole, our data strongly suggest that clippings are an integral part of reading and accessing published material. Clippings supplement memory; they make reference information personally accessible; they stimulate ideas; they keep vital information visible; and they act in a variety of social roles when they are shared with friends, family and colleagues. Thus, clippings are saved in different forms and for a variety of reasons. Furthermore, we observed that the study participants had difficulty knowing what would be valuable later, that many nevertheless felt guilty about being "pack rats," and that they were often unsuccessful in finding the material they had saved (or even knowing they had saved it) when it would have been useful. It is also clear from the data that encountered information of this sort has the potential to be valuable and useful in a number of different situations.

Our user interfaces to the Web, digital libraries, and other information resources need to take into account the value of encountered material. People are deriving value from saving and sharing the material they run into during the course of everyday reading; it is easy for us, in a digital environment, to become too narrowly focused on search and information needs-directed browsing, on personalization and eliminating incidental contact with unnecessary information. In the larger scope, it is important for us to keep an eye on the role of serendipity and breadth of exposure to information to reduce fragmentation of communities and to foster creativity and learning.

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