The Gray Lady Gets a New Dress: A Field Study of the Times News Reader

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ABSTRACT
Increasingly individuals are turning to online sources for their daily news. Traditional newspapers have developed significant web presences to compete with newer services such as news aggregators and emerging genres such as blogs and other forms of citizen journalism. This paper reports the results of a field study to investigate the use of a new RSS-driven, template-based presentation mechanism that delivers a daily newspaper to subscribers' laptops and desktops; the Times News Reader hybridizes elements of print newspapers with aspects of online news. We explore how this application compares with print and web-based news reading and evaluate functionality developed to draw in readers from both audiences. Finally we examine three general technological implications drawn from current use: how the news reader may adapt to different styles of reading; how the news reader's functionality may be extended to highlight the timeliness of the content and to personalize the application; and how long-term use of the news reader can result in a personal news archive.

Categories and Subject Descriptors
H.3.7 **[Information Storage and Retrieval]**: Digital Libraries – *User issues*; H.5.2 **[Information Interfaces and Presentation]**: User interfaces – *Evaluation/ methodology*

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Design, Documentation, Human Factors, Performance.

Keywords
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1. INTRODUCTION
The future of journalism and print newspapers has become fraught with controversy as a growing number of readers turn to the Web for their daily news; the health and viability of the newspaper as an enterprise has been called into question as newspapers' economic support from regular subscriptions and advertising weakens. At the same time, citizen journalists have been playing an increasingly important (if not always trusted) role in news gathering and reporting [24]; citizen news sites such as Wikinews and OhmyNews entrust the editorial filtering and some of the reporting and writing to amateurs. The Korean language OhmyNews even provides a mechanism for readers to tip the self-styled reporters. News aggregators such as Google News further complicate the picture by assembling articles from a wide variety of daily newspapers and wire services worldwide with differing editorial policies and reputations.

Yet news sources are as important as ever for disseminating complex information about the world around us and for providing multiple points of view and additional details about events. Newspaper archives continue to play a role central to many kinds of research. Mass digitization projects to build retrospective digital libraries include newspapers [1] and many newspapers are providing online access to their digital archives (and indeed are wondering how to expose their archives to web indexers so they become part of broader search results). It is no surprise that newspapers currently devote a significant portion of their resources to their websites, experimenting with facilities as diverse as discussion forums, message boards, and interactive advertising. They are concerned about their relevance, retaining their local audience, differentiating their publication, and in some cases, their very survival as the number of news dailies shrinks.

This paper describes a field study of an RSS (Really Simple Syndication) based news reading technology, the Times News Reader. As the name suggests, the application delivers a specific daily paper – *The New York Times* – to subscribers' laptops and desktops. The application has much of the usual functionality one associates with news websites, such as the ability to save, share, search, and print articles, coupled with standard desktop functionality such as the ability to annotate content. The application also uses templates to capitalize on new adaptive layout capabilities and experiments with some navigation and visualization functionality. It is designed to automatically download an entire daily newspaper overnight, so that the news may be read offline, for example, during a morning train commute or on an airplane.

While the field study has been a useful test of the application's capabilities and its overall usability, it has also provided an opportunity to explore some aspects of the future of newspapers and the presentation of the news. Specifically, we were able to evaluate whether an application that delivers an entire newspaper that looks more like the print publication and can be read offline was still seen as being comparable to the newspaper's website, or whether it was perceived as a potential replacement for the print paper. In an earlier

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study, Watters et al. found that a broadsheet metaphor was more effective than a document metaphor for presenting news [25]; the Times News Reader is pushing in this direction and is a good vehicle for investigating this laboratory finding in the field. We were also able to explore subscribers' expectations of a print-like publication – did it fulfill their purposes in reading the paper? Finally, we were able to investigate additional functionality that would potentially retain subscribers (or deepen their loyalty to a particular publication).

This paper describes the study and briefly explains the application before presenting the study's results and examining the technological implications of delivering this type of RSS-based publication to subscribers' laptops and desktops.

2. STUDY DESCRIPTION

We performed a qualitative field study of the Times News Reader (TNR) application; study participants installed the TNR on their own laptops and used the application for approximately two weeks prior to the interviews, a period during which they kept a journal documenting their experiences, in part to help them recall the installation process and specific instances of use that we would ask about during the interviews. They also completed a survey prior to the interviews. The respondents brought their laptops with them into interview facilities in the cities where they worked; looking at the product together as they saw it on their own computers helped prompt them about specific experiences and difficulties.

The interviews were an hour long and semi-structured, with significant internal triangulation to verify participants' responses. The interviews were recorded, including the participants' projected laptop screens, which they used to illustrate what they meant during the interviews. The participants' laptops revealed many aspects of their use of the application: when they had last synchronized, for example, and how much of that day's paper they had read, as well as whether they had read the paper within the last few days. The interviewer was careful to divorce himself from both Microsoft and *The New York Times* to make participants more comfortable with discussing the application freely.

Twenty-two study participants were interviewed in three cities: New York, Chicago, and Austin. Five of the participants were subscribers who mainly read the print *Times* without accessing the website and another five were print subscribers who also used the NYTimes.com website; these ten participants were recruited from a list of paid print subscribers. Twelve other participants were occasional or frequent users of the NYTimes.com website without subscribing to (or paying for) the print publication; these participants were drawn from a database of registered NYTimes.com users. Recruiting participants in three different cities with varying online reading habits ensured that we had a diverse subset of people who were familiar with *The New York Times* and fell within the paper's demographic audience.

We were particularly interested in "reading on the go", so recruitment aimed to include some readers who commuted by public transportation to their workplaces or traveled on business. Commuters were defined as those readers who carried a laptop and rode the bus or train for at least twenty minutes to get to their workplace. Participants were considered business travelers if they took at least five round-trip flights per year, carrying their laptops to use on the plane. We also included respondents who owned laptops and sometimes brought them along to places other than their normal desktop environment (for example, to a café) or engaged in micro-mobility in their houses.

Because we were evaluating an RSS reading experience, we specified that participants must have broadband Internet access at home; that they must be online more than three hours per week; that they must already read some news on the Web; and that they must be familiar with *The New York Times*, either as a print publication or as a Web publication. Because the application uses a new Windows facility (Windows Presentation Foundation or WPF, a graphical subsystem of the .NET Framework 3.0), participants were also required to run Windows XP.

Since the study targeted the normal demographic audience for *The New York Times*, some respondents participated in the study out of loyalty to the newspaper. "I'm a fan. I'm happy to participate," said one respondent who does business development for a Chicago law firm. Respondents also received a substantial cash incentive for their participation. They were by-and-large older, well educated professionals – attorneys, doctors, businesspeople, analysts, and teachers – who exhibited varying degrees of technical sophistication and enthusiasm for technology in general. Respondents spanned an age range from 22 through 64; the average age was slightly over 40 to align with subscriber demographics. Although the participants were interested in the future of the newspaper, generally they were neither technophiles nor early adopters.

From the 25 logs and surveys that were completed prior to the interviews[1], we established that the median amount of time that participants spent using the Times News Reader application over the two week period (not including the initial download and installation) was about 3 hours and 45 minutes. The median number of application uses was 8, which translates to reading the paper roughly once every other day. Twenty-four of the twenty-five respondents used the application 5 or more times and seven of the respondents used it 10 or more times.

3. TIMES NEWS READER APPLICATION

The Times News Reader application was a collaborative development between *The New York Times* and Microsoft. Applications developers used a graphical toolkit called the Windows Presentation Foundation (WPF) that includes facilities to define template-based adaptive layout. Adaptive layout algorithms create a multi-column presentation of the text and inset photos; the text reflows according to template specifications, the window dimensions, and the font size. WPF also provides capabilities for building an appropriate user interface for this kind of application.

The TNR application synchronizes a local cache to contain all of a particular day's stories as determined by the contents of the RSS feed. The application may then be used to read the newspaper offline. Settings allow users to specify when this synchronization occurs; by default it occurs overnight (for example, at 3AM). The application also polls for changes at user-specified intervals

[1] The discrepancy between the number of surveys (25) and the number of interviewees (22) is that extra participants were recruited in case there were no-shows, a common practice in doing this kind of qualitative research.

Figure 1. The front page in the Times News Reader

whenever the PC is left online; the default for this polling interval is every 30 minutes.

Figure 1 shows a recent front page of *The New York Times* in the TNR interface. Figure 2 shows the body of a typical news story.

The reader can navigate through the newspaper a number of different ways: by using hardware arrow keys; by clicking on the soft article and page arrows at the bottom right of the window; or by selecting one of the section tiles along the top. It is possible to page through the entire newspaper using the forward key; this design was specifically aimed at readers using devices like tablets who might be reading while they are commuting. Drop-down menus (available from the section tiles) offer access to all of the locally cached news articles; each menu entry is an individual headline. The reader may also click on a headline to navigate to a story. Arrows at the top left operate like a browser's Forward and Back buttons. The application can be run in full screen mode (in which the window controls disappear and the TNR fills the reader's screen) or in a normal resizable window.

Within an individual story, the application offers standard news functionality, plus a few additional features. Figure 2 shows a typical news story page. Readers may save, share, or print a story or change the size of the reflowing text (see the slider at the bottom left corner of the window shown in Figure 2); if the text size is increased, the number of columns is reduced so the column width

Figure 2. The body of an article in the Technology section

remains optimal for reading. Readers may also annotate, highlight, or attach notes to newspaper articles. As past studies predict, sharing and, to a lesser extent, saving are important functions for most readers; annotating and making notes are less so [17]. Readers can also search through the text of all cached articles; results are displayed in a list or visualized by relevance or topic. A "Show What's Read" feature displays a visual representation of all of the articles in a section (or in the whole newspaper) so a reader can determine at a glance how much he or she has read and browse to find unread material.

4. RESULTS

Data gathered during the interviews will help us answer the study's overarching questions about the role of the Times News Reader: Will the paper-like layout, page-based navigation, and offline access lure print subscribers to the screen? How will the application be used relative to news websites, particularly the *Times*' own NYTimes.com? We will also discuss our evaluation of the application's features, focusing how they reflect on newsreaders in general rather than on how they have led to specific design changes.

4.1 News Sources

One of the advantages of reading online is that so many news sources are available; one's own laptop can become a more extensive window on the world than the reading room of a well-funded public library. Participants commented on the broad availability of news sources; many of them frequently consulted a number of different broadcast forms and online news sites, sometimes using the compilations assembled by news aggregators. In fact, more than half mentioned using at least one automatic or manual aggregator such as Google News, Yahoo News, or Drudge. Some respondents read political blogs and listened to online broadcasts as well.

What stood out is that many interviewees are moving away from TV news (with the notable exception of *The Daily Show*, a news satire that often serves as a surrogate for real news sources); several participants actively asserted their distaste for conventional TV news programs. Specific authoritative publications still hold sway: besides reading news in the *Times*, respondents also cited other trusted sources such as *The Wall Street Journal* and periodicals like the *Economist*. Two-thirds (12/18) of the participants in the portions of the study that took place in Chicago and Austin still read a local paper – the *Chicago Tribune* or the *Austin-American Statesman* – in addition to national publications like the *Times* or *Wall Street Journal*. Even in New York City, several participants said they read another of the local news dailies such as the *New York Post*. Getting local news was still important to participants, regardless of the perceived quality of the local paper.

It is easy to see that for our respondents, *The New York Times* is part of an entire spectrum of news sources they encounter on a given day. If we consider the role of our RSS application in their news reading experience, it is unlikely that it will fully substitute for either their online or paper sources; rather it will co-exist with the others. Reading the news – or, more aptly, getting the news – is a complicated, fragmented affair that takes place at various times of the day, across a variety of media (including print and broadcast TV), and takes advantage of the diverse sources that are available on the Internet. Even if the News Reader were generalized so it could be configured to accept many different RSS feeds, it would still not

cover the ground that the study participants regularly traverse in their daily news gathering.

4.2 Multiple Purposes for Reading

What do we mean when we talk about reading the newspaper? It is easy to form a mental image of a commuter reading the *Times* on the Long Island Railroad or a student relaxing with the Sunday paper in an open-air café on a sunny morning. If we are too quick to jump to conclusions about how, why, and where people read the newspaper, we can be misled about what is important in a news reading application and emphasize one kind of functionality at the expense of another.

Study participants read the *Times* – either as their primary news source or as a secondary news venue – for different reasons. For example, they may trust the journalistic integrity of the news reporting; they may appreciate the depth of news coverage; they may feel that the editorial columnists are exceptional; or they may find the features to be an entertaining diversion. The reasons people read the news – and read *The New York Times* – colored their reactions to the TNR application. Sometimes participants' abstract reasons for reading the *Times* (no stories about Paris Hilton on the entry screen, for example, or that the stories are well thought out and fact-checked) are somewhat dissonant with their actual reading practices (they are primarily seeking the latest news and don't look too far beyond the headlines).

Regardless of their purpose for reading the newspaper, participants expected the RSS application to deliver all of the content they would encounter in the print publication, be it a favorite columnist, a regular feature in the Sunday magazine, or even the ads:

> "What I did miss, funnily enough are the ads. It's weird, but the Saturday and Sunday editions, especially the Sunday edition, there are a lot of ads. [You can find] specials on Broadway shows. I do use that a lot to book my tickets online."

Although study participants articulated many reasons for reading the newspaper, three general styles stand out among them:

- Reading primarily for relaxation and as a diversion;
- Reading as a newshound, following the narrative of specific breaking stories or particular recommendations; and
- Reading broadly to stay informed or to keep up with events of the day.

Reading for relaxation. Participants who read the print newspaper as a source of relaxation are apt to distinguish between getting the news (which is a quick, scan-intensive process that relies on timely dissemination of events) and reading the newspaper, which is relaxing and may involve reading features and columns that are enjoyable, informative, or engaging. A single participant may do both: he or she will read online to stay caught up on the news, but may also subscribe to the print edition on Sundays and be unwilling to switch that practice to the TNR; there's a certain ritual associated with the Sunday *Times* that he or she is reluctant to give up. Some participants mentioned bringing the newspaper with them to a café, reading in the bathtub, or lying back on the couch. It's not that the participants couldn't read from their laptops in bed; it's that they wouldn't. One of the younger interviewees (a woman in her late 20s who was a very enthusiastic proponent of the Times News Reader technology) said that she wouldn't give up her Sunday print subscription, saying that "it's a religion for me… I like vegging out and getting a Bloody Mary." These readers are apt to regard the physical form of the *Times* as irreplaceable. One print subscriber said:

> "In the summer, my family and I … have a beach house and that's one of the times that we're all together. We all sit around and we read different sections of the paper. That wouldn't happen if we were all getting our info from the computer."

Reading to follow breaking stories. Newshounds emphasized the timeliness and depth of the material. They are reading the news as a dramatic narrative, following journalistic breakthroughs on a story, and are interested in the event details as they unfold. These readers may gather different sources to fill in the gaps on a single story, and are often driven by an encounter in one medium to seek details in another:

> "For example, there was this news about Wesley Snipes being arrested. Which was flashing on the banner stuff. And I wanted to know. … I came back home late, so I missed the evening news. It was that in-between couple of hours. It was 6:35, actually. So I missed the 5:00, the 5:30 news, and I wasn't listening to the anchor. In any case, I went online—actually, the TV was on. And the TV was talking about this. And I went on the Times Reader to try and see if it was there."

Not only is their reading expectation-driven; it is also social, as we saw in [17]:

> "A lot of times what will happen is we'll start talking about something in the office and everybody'll be like: 'oh. Well I saw it on blah-blah-blah a few days ago.' So it would be nice to be able to go back and find that article."

In fact, not finding an anticipated story was a great source of annoyance and dissatisfaction for newshounds, especially if they knew it was available in the print publication or on the *Times* website:

> "It was a few days ago. Michael J. Fox was accused of [faking]. So I saw that, I was on AOL for a moment. So I just got the quick headline and I got the photo. And so I thought this was a perfect use for [the TNR]. So I came here. And I looked on the first page and it wasn't there. And I thought, 'where could it be? Could it be under US?' No. It wasn't there. And I thought, there's got to be a political section. And I went to More, and it's not there. But with NYTimes.com it was right there."

Other participants who approached the TNR with a specific story in mind echoed this participant's frustration with the standard newspaper section structure; they are oriented to fresh news and prefer a CNN-style "breaking news" format.

Reading to stay informed. Still others read to keep up with the breadth of events of the day; these readers scanned the paper, looking for key stories to pop out at them, or to sync up with other news sources they had encountered during the day, for example headlines glimpsed while walking down the street. They are interested in broad-brush coverage of what is going on, rather than

following particular news items or reading features for enjoyment, and may want to be sure they have seen the whole paper or whole sections of the paper. For example, one participant who worked in a law office and characterized himself as a frequent reader of NYTimes.com said:

> "What I really do with the NYTimes.com is I scan the headlines, because we have different practices, we have different clients. I like to know when someone is in the news so we can respond. So I can get my attorneys prepared—so we can be knowledgeable."

He went on to describe how he reads the news:

> "I know where to look for Markets. I know where to look for Opinion, because I always read that. And then I scan down—I have really demanding health care guys—I'm always looking in those sections to see who's there and who's not. Or [looking for] related articles on the industry. It's really about seeing it, finding it, and moving on. And I see it all at once."

Respondents' impressions of the TNR application and satisfaction with the features it offers depended on their purposes and the other news sources they consult. For example, newshounds might report dissatisfaction with the apparent timeliness of the material in the TNR. Not only does this type of reader want up-to-the-moment coverage of events, he or she might also want quick access to "what's new," to put a watch on a particular story, or to locate the story that other people in the office are talking about. On the other hand, the participants who read to keep current are skimmers and scanners; their satisfaction hinges on their ability to get through the paper quickly without missing something important (or, as the participant above noted, seeing what is there and what is *not* there). An interface that demands a lot of page turning to cover everything they are interested in might not be right for them. Respondents who read for enjoyment are looking for the immersive experience that the print newspaper offers and may be delighted with the high-quality typography and layout, but may also report dissatisfaction because there is no getting around the difference in the materiality of the product and how this difference influences their newspaper reading rituals.

What seemed universal for our respondents is that the TNR application mixes the print, web, and RSS metaphors, and this will require some means of compensating for the deficiencies of the mix and for disambiguating what's there and what's new. Participants suggested lots of different ways fresh content could be highlighted; the common thread is that they wanted to know what was new since the last time they had looked at the TNR and where it was in the paper. They also wanted to be able to reliably locate content they knew was published in that day's paper. When we discuss design implications, we will address this kind of compensatory functionality and ways for fitting the application to the subscribers' range of purposes.

4.3 The TNR v. Print Newspapers

One of the rationales for a screen-based presentation of the newspaper addresses the perception that printing and delivering the physical newspaper is wasteful and that there are clear advantages to receiving a newspaper subscription on the screen: "I read the whole thing and I end up with this bunch of trash. Which I've got to chuck. This is a lot cleaner." Furthermore, early morning commuters will no longer face the frustration of having the print newspaper arrive on the doorstep after they have left for the train. A digital version of the paper is convenient, neat, and can be augmented by useful features. At the same time, if the subscriber's major motivation for reading the newspaper is relaxation or involves a particular ritual (say, scanning it quickly on the way out the door), he or she may lament the loss of physicality; the material form of the product is central to its use.

The TNR application is designed to improve the experience of reading on the screen so that the digital version of the newspaper may compete with the print publication. The question is, was it successful in doing so? It seems that most participants had a positive overall reaction to the application; two-thirds rated it as "Excellent" or "Very Good" in the survey and half considered themselves very likely to continue using the application as long as it is free. All of the participants categorized as business travelers thought they would continue to use the application, as did more than half of the commuters. Unsurprisingly, the two groups of participants most apt to discontinue use are those who don't often travel or carry their laptops with them and those who subscribe to the print publication. One of the participants who is not a traveler, but who frequently accessed the website said, "I get *The New York Times* at work. I don't carry my laptop. It's too heavy. It [the TNR] doesn't make sense." The barriers to continued use parallel many of those for e-books [16]: respondents don't carry their laptops all the time; downloading the digital paper (even automatically) doesn't fit into their routines; and the physicality of the paper is important to them.

The TNR application has a strong emphasis on legibility and readability since it capitalized on adaptive layout and ClearType [7]. This aspect of the application was generally successful. Many of the participants commented that they liked the look and feel of the application, the crispness of the text, and the simple interface for reading; format was judged to be the most successful aspect of the application, as was the quality and clarity of the photos. Several study participants even said that they were more comfortable reading the *Times* with the new application than they were with reading the *Times* in print, a preference which surely marks a sea-change for reading on the screen. A few others found it perversely old-fashioned, since it looked more like a broadsheet newspaper than like a website; one respondent even commented, "It reminded me of a microfiche reader."

Overall, reactions to the application's desirability are likely to have been swayed by its connection to *The New York Times* itself; the newspaper's journalistic reputation and quality were often folded into interviewees' comments about the TNR: "It is *The New York Times*. There is a certain built-in trust that I have that they're probably accurate and well thought out."

4.4 The TNR v. Web Newspapers

Most of the respondents were familiar with the newspaper's website. In fact, 17 of them cited the web version as either their primary venue for reading the *Times* (12 out of 22 or 55%) or a source they consulted regularly (5 out of 22 or 23%). Not surprisingly, respondents were more likely to compare the TNR with the website than they were with the print publication, even though they acknowledged that the look is comparable to the print broadsheet. Figure 3 shows a recent NYTimes.com front page.

Figure 3. A recent front page on NYTimes.com

The consequence of this comparison is that expectations of functionality and organization are set by the website. Sometimes participants referred specifically to missing website features that they enjoy, for example, the list of "most emailed stories" or the crossword puzzle. Participants who read the paper to keep up-to-date also tended to believe that they could see more at once on either the website or in the print newspaper – that either is easier to scan quickly than the Times News Reader.

Because immediacy and timeliness are cited as crucial reasons for reading online news, participants are drawn to the website as more closely matching their motivations. Because broadband access is becoming so ubiquitous – wireless everywhere – the TNR's advantage of disconnected access did not appear to act as a crucial differentiator, except for those interviewees who commuted on certain kinds of public transportation like the train. There was a stated resistance to pulling out a laptop on the bus or subway as either geeky or inappropriate, especially "if you're sitting across from some drunk." The commute also has to be long enough – longer than a half hour – for it to be worth it to pull out a laptop. When these restrictions began to mount, the niche for an offline application became smaller and the comparison with the website became more obvious.

Offline access also crucially relies on either opportunistic or scheduled automatic synchronization, which in turn encompasses many assumptions – that the subscriber connects his or her laptop to the network often or at appropriate times and that firewalls would not interfere with synchronization. For example, one study participant who had just returned from a business trip said:

> "This morning when I was in the airport … I went out and I bought the hardcopy. I was sitting there reading it and I thought, 'I could've just looked at it on my computer.' But then I would have had to log on. I would've had to pay for the wireless connection at the airport…to get today's news. I would've had to go through the whole hoopla of getting wireless through T-Mobile and sit and wait for it to download."

For an opportunistic reader who reads the news on and off during the day whenever there are a few minutes to fill, planning a prolonged synchronization process may be difficult.

4.5 Synchronization and Accumulation

The Times News Reader synchronizes automatically at a set time and at regular intervals thereafter if the host computer is online; it also synchronizes on demand if the reader requests an update. The day's content is downloaded and cached locally (to a file system directory). According to user preference, the application may continue to synchronize even when there is no visible manifestation of the newspaper on the screen. The local cache is emptied regularly to get rid of older articles; it may also be emptied on demand.

Full synchronization appears to be a double-edged sword – almost all of the participants complained about how slow complete synchronization was, yet they contradictorily did not want to be "punished" for not synching up on a particular day and losing that day's content if they wanted to read it the next day. Several study participants actually used the word punished when they were asked about missing a recent day's paper: "I'm being punished for not reading the paper." They felt that they should be able to look through the paper when they had time (or look for a recommended article) even if it were a day or two later.

This conflict suggests that the archival function of the news reader be divorced from the immediate synchronization. That is, synchronization should always retrieve new material first so the reader can retrieve breaking news, and gradually try to catch up with missed material from the feed. It is likely that the subscriber will want better control of the cache too; it seems like an important benefit to be able to amass old newspapers (especially valuable news sources like the *Times*) if one wishes without bearing the cost of huge messy stacks of old print newspapers.

In fact, some participants saw a decided benefit in accumulating all or part of the newspaper on their laptops. One participant who used both the website and subscribed to the print newspaper said:

> The only way that I would want to get something from an archive is that I previously read it and didn't keep it at the time. And then I would want to go get it because I remembered something from it that was relevant, maybe a recipe or something like that… [For example] I want to enter 'Pinot Noir' because I read a good article that rated some wines and then it would come up with every mention of Pinot Noir."

If this local personal archive – marked up and culled according to user preferences – were coupled with searching and topical browsing capabilities, subscribers would be able to query every paper they had ever purchased and, for example, find a half-remembered recipe they had encountered in the past or an article they recalled reading and wanted to find again.

Many of the participants did not fully understand synchronization. They often failed to explain the current state of the TNR, why some days' newspapers were missing or why old headlines appeared. A message that informed them that the application was still running (to maintain synchronization) when they closed the application's window baffled many of our respondents. This confusion suggests that it is important to convey the state of the content (relative to other places they might read the paper) very clearly to the user.

4.6 Personalization

Personalization was a key part of the original design of many digital newspaper research prototypes [10, 6, 2, 13], and was recognized as desirable before these prototypes were even feasible [3], despite some reflection on the value of the genre as a cultural touchstone [20]. Many current online newspapers have incorporated some degree of personalization, whether it is maintaining a "watch" list of important topics or keeping track of how you have done on the daily puzzles.

Thus it seems that many readers of online news products have grown to expect at least some personalization to be offered. Participants mentioned a number of ways they expected this personalization to occur, whether it was tailoring the feed ("don't download sports"), constructing a "My Times" view (the ability to construct a "to read later" list was seen as a good first step in this direction), or even personalizing the navigation tile layout to match the order in which the respondent read the newspaper sections. Personalization was viewed as a way that the Times News Reader could be more valuable to subscribers; several readers cited in particular that they thought the performance would improve if the application only downloaded articles in the sections they normally read.

Participants also thought that the application should include a recommendations based on what others were reading or other functionality that would enhance serendipity and suggest further reading. For example, one interviewee said, "I would be more interested in knowing what other people were reading." This kind of recommendation may grow to encompass the kind of functionality described in [21] or the mechanisms pioneered in [22]. Some participants mentioned that they already used some of the *Times* website features to extend their reading interest: NYTimes.com includes a list of the ten most emailed stories, the ten most blogged stories, and the ten most popular search terms; these implicitly recommended articles were seen as valuable venues for serendipitous encounter.

With personalization comes a concomitant concern for privacy. Any personalization requires the development of a sophisticated privacy policy, since it requires the ongoing maintenance of personal information about the reader's interests and habits. This concern was duly noted by several participants.

Although this privacy concern seems self-evident, it is clear that some readers are becoming more ambivalent about their privacy. As other research has found, most people will sacrifice some of their privacy if they are immediately aware of what they get in return [5]. On the other hand, some subscribers may be sufficiently concerned with privacy that they are only willing to store and control personal data locally. And certainly, as recent research has confirmed, people who are concerned with their privacy in the abstract will often deviate from their principles if a significant reward is offered [8].

4.7 Content Organization

The Times News Reader presents content in an organization that is very similar to the print newspaper (the web site does so too to a great extent), rather than presenting it according to timeliness. Unlike the last-in, first-out organization that is frequently used by aggregators or breaking news sites such as CNN.com, the *Times* uses editorial judgment to position and segment the stories.

However, this organization may be at odds with peoples' growing experience with online news. Participants in our study frequently perceived online news as a way of following breaking stories and keeping up with the latest news. Thus the application's mix of updated content with older content confused some of our participants. They frequently requested a way of quickly picking out "what's new" – breaking news, for example, or unfolding stories that they are following. Because day-old stories may remain in the feed and mixed with new content, one participant who was accustomed to reading the print *New York Times* said, "It's too much of a mish-mash."

Time stamps and representations of temporal order are very important in news reading applications. Participants not only wanted to know which of the stories were the most recent; they also wanted more feedback on how long a story has been posted and its relationship to previous news items, for example whether it updated or corrected an ongoing report. One participant in Chicago even noted that she did not know whether the time stamp on the stories reflected Eastern or Central Standard Time. Participants placed a substantial emphasis on knowing which stories are breaking news and the temporal relationships among articles, especially if they are viewing the application as a replacement for the website.

4.8 Navigation

As we noted earlier, the application presented readers with many ways to move through the paper. Tiles across the top provide immediate access to section front pages; drop-down menus accessible from the section tiles contain a list of all of the section's headlines. Hard and soft arrow keys allow the reader to page through all of the articles or through all of the front pages of the sections. As in the website, all of the headlines and story blurbs are clickable and give the reader another entry point to specific stories that pique their interest. A "News in Pictures" slideshow presented a large view of the day's photographs one by one; clicking on one of these photos would bring the reader to the corresponding article. Search functionality provided yet another access point; this type of access is useful for older material, remembered stories, or to track down articles that have been recommended in another medium (for example, several readers cited having heard about a story on NPR or CNN and following up in the Times for more depth).

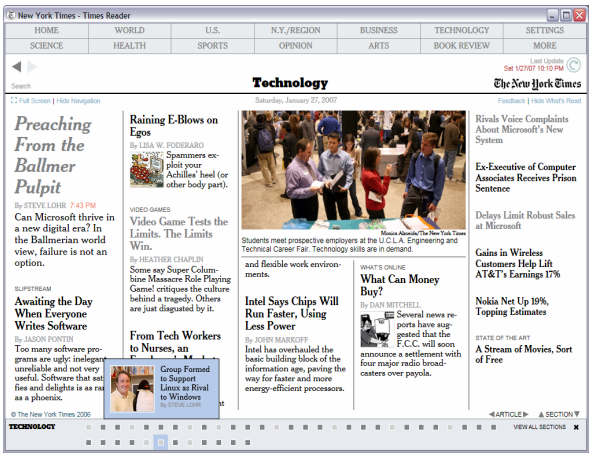

Figure 4. A visualization of what has been read.

The advantages of having so many ways of navigating through the daily newspaper are apparent; multiple access modes caused some of the participants to read more of the paper and to spend longer doing it. One participant said, "The [print] newspaper isn't set up this way – I saw more things that interested me." It is interesting to note, however, that readers mainly used the navigation modes that were the most readily apparent to them (the section tiles and clickable links) and were apt to become disoriented when the tiles shifted positions or sections appeared to be missing (when they were hidden behind the "MORE" tile, for example).

The Times News Reader also included an experimental visualization designed to show people what they had read and to give them a preview of what remained. Figure 4 illustrates this function in use; hovering over one of the small gray rectangles that appears below the page pops up a headline and the article's photo. Unfortunately, study participants had trouble discovering this function; even when it was demonstrated for them, they had a hard time figuring out what they were supposed to have seen. Most of them did not see the function's utility. "I usually *remember* what I've read," one participant said. Another said:

> "Why would I want to know that? I would never do that. I would be more interested in knowing what other people were reading. I know if I've read it. If I accidentally clicked on it again, I would just say 'oh, I've already read that.'"

Although this visualization seemed compelling during design, it illustrates how difficult it is to provide unaccustomed modes of access to newspaper content.

5. IMPLICATIONS

A hybrid RSS news reader of this sort is necessarily going to raise subscribers' expectations. It must compare favorably to both the print newspaper and to the newspaper's website to gain a foothold in the changing world of online journalism. Because people come to the newspaper with a multiplicity of purposes,[2] this kind of application must ultimately be tailorable and fit in with the broad variety of news sources. We divide our suggestions into three general areas: (1) Adapting to a range of reading practices; (2) Extending functionality to improve on the print newspaper and the website; and (3) Making the digital newspaper part of a portable personal digital library of collected materials and resources. We cover each area briefly in turn.

5.1 Adapting to a Range of Reading Practices

Our participants described different ways they read the paper. Some of them highlight in-depth reading of particular articles of interest; others emphasize going through the whole paper very quickly; and still others are focused on an unfolding narrative, reading interrelated breaking news as it happens. In this section we will focus less on specific aspects of the *Times*, since for many of its subscribers – and even for its occasional readers – it holds a special place as the trusted "paper of record" and is probably less often used as a venue for keeping up with breaking stories. Instead, we will consider what we observed, and what participants told us, in a more general light.

First, it is evident that reading, skimming, and scanning may each require different presentation, navigation, and visualization styles [21, 9]. The current design is very much oriented toward reading in depth. How can we support skimming – which is thought to rely on highlighting aspects of a longer text that are considered to be of particular interest – and scanning – a reading mode oriented to getting a gestalt of what's going on? The current design also de-emphasizes the concept of breaking news; what can we do to help readers find new material at a glance or follow a story as it changes over time?

One thing that is important to support the kind of in-depth reading that participants reported (and seemed to do, according to the triangulation data we collected) is to provide a stable sense of the newspaper's substructure. That is, if readers are drawn to stories in the Arts section or read the Obituaries first, then we need to support their quick access to these regularly occurring features and their equally rapid return to the front page or the section front. Readers appreciate feedback (which they are already given) about the story's length and metadata about publication time. They also use the standard save, share, and print functions and may even mark the story up; these functions are currently better integrated into the computing environment (for example, email accesses the reader's local contact list) than they are for server-side news presentations; however they still make assumptions about the user's platform. Does the subscriber use server-side email? Many of our participants did.

Skimming is tricky. Many prototypes to support skimming have been developed over the past decade or so [21]; yet they are not incorporated into widely-used applications.[3] They have generally used content analysis techniques to identify words, phrases, or sentences of interest, and have applied a visual highlighting technique to make these textual elements stand out or to indicate the topic structure of a long document [12, 4, 11]. Other social techniques have been suggested as well [15]. Incorporating skimming technologies will require a deeper understanding of how skimming works and which aesthetic principles should be maintained in text presentation.

[2] Including training the dog; we do not address all of our readers' purposes in this paper.

[3] And if they are, they are not used. See, for example, MS Word's hidden automatic summary generator on the Tools menu.

Skimming may also be facilitated by distinguishing what is new in a given story from what the reader saw last time an event was reported. To refresh the topic in some readers' minds, a certain amount of redundant explanation is introduced. If a reader were able to distinguish between old and new coverage of a particular event, skimming a long story will be easier.

Scanning will require new support for visualization and navigation. One of the most interesting comments participants made had to do with how a broadsheet is better for quickly scanning the news. This is apt to be due to how much is visible at once, and how many levels of detail may be apprehended at a single glance (that is, a reader can see whatever story details and photos that pop out at him or her in addition to simply looking at the headlines). Other work assessing trade-offs between page-turning and scrolling in the specific context of scanning will also be necessary. Within document visualization techniques allow readers to flip very quickly through the individual pages of a long document [23]. Yet we have already seen that our participants exhibited some discomfort with visualization techniques for scanning the newspaper; witness the lack of enthusiasm for the "show what's read" visualization; there is much work to be done to make the promise of visualization address the needs of the casual reader.

5.2 Extending Functionality

It is important for the news application's functionality to both echo and improve upon what the reader is familiar with. Sometimes this type of extension will just require adding content to the feed (for example, most emailed stories) and sometimes it will mean making features available that require new capabilities to be developed (for example, the Times crossword may be played competitively or socially on the current website).

Timeliness can be an important aspect of reading the news. There's no great love for yesterday's papers. In a news application, meaningful and readily visible representations of time are crucial. Readers invariably consult a story's date and time to guide their interpretations of the news. It should be easy to find the breaking news (either organizationally – as in a named view – or even just visually within the current organization). Similarly, anything related to synchronization must be communicated clearly and oriented to the consequences of the action. For example, respondents set their expectations by the synchronization time stamp, as illustrated by our earlier example of the participant looking for updates on Wesley Snipes' arrest.

Personalization was a recurrent theme in our interviews. So many web applications are personalized that people have come to expect at least some amount of adaptation and local control of what is presented to them. Simple types of personalization that arose in the interviews (or from observed practice) include incorporating a to-read list in the navigation bar; giving the reader the ability to organize the tiles in the navigation bar; allowing the reader to control which sections they cache from the feed; and providing a means to configure the application so that people can include other favorite news feeds in the newsreader (in a way that does not in any way conflate the articles' source). Because the Times News Reader runs as a local application, it is possible for subscribers to control personalization and interaction data locally, rather than on the server side; this local control gives the offline product the perceived benefit of being a private copy of the newspaper.

5.3 Personal Newspaper Archives

One of the aims of reading and interacting online is to amass materials to form a personal digital library that includes traces of the user's interactions – a personal information geography, if you will, that records where the user has been and what he or she has read before [16].

A person's daily encounters with the news should become a fundamental part of such a personal digital library. Thus the cache need not be just the last few days' newspapers, but rather as many and as much of the subscribed content that the individual wishes to keep. As many researchers have pointed out, storage limitations are quickly falling away. Thus the main concern is with stewardship of personal digital belongings distributed across many different computers [18]. In the case of a newspaper, it is possible to take advantage of genre and metadata to ease the curatorial burden; it is also possible to restore lost material from the newspaper's own archive using subscription records.

Furthermore, the individual's interactions add value: it is easy to record what has been read (and even the extent to which it has been read), where the content is from, possibly who recommended it, and any permanent annotations or marks that the reader has made. This type of record allows complete newest-first synchronization to occur without overwhelming the reader. An archive may also be separated from the cache of current newspapers; adoption of a long term view for such a store suggests that the newspapers be saved in a canonical format that may be migrated as necessary [14], rather than in the news reader's native format.

A synchronization mechanism, coupled with the ability to specify additional secondary news feeds, would enable a subscriber to download a wider range of news to read as a personal publication and to use to amass a personal news archive. Clear indicators of an article's provenance would allow a reader to assess content integrity while still casting a broad net in his or her daily reading and in accumulating a useful resource.

Of course, long-term access techniques are of central importance too. Searching a newspaper's public archive is different than searching one's personal collection. As one of our participants noted in an earlier quote, factors like whether an article has been read before, whether it was deemed valuable at the time, and the context in which it was seen all come into play. It is also natural to look through one's clippings as a means to re-encounter forgotten material. Topic segmentation of this personal collection may also add value: it is different to look through one's recipes than it is to look through old obituaries.

It is easy to see how the power of reading online can be amplified by attention to how we might use what we have read later.

6. CONCLUSION

Of late, there has been considerable speculation about the future of traditional newspapers, given the apparent loss of younger readers and the waning recognition of in-depth journalism's value in a world that increasingly relies on blogs and aggregators [19].

Yet there seems to be an important role to be filled by authoritative newspapers such as *The New York Times*. Complete disintermediation can lead to naïve interpretations of events and their significance and a fragmentary awareness of the world at large. It is also rare for citizen journalists who go it alone to have the

resources for fact-checking and professional writing, editing, photography, and other types of media preparation.

What needs to be done, then, is for traditional newspapers and news organizations to jump into the mix, to become a wholly integrated part of the everyday online reading experience. Reading the news online can be powerful and need not be demographically limited to the young and the technically sophisticated. Platforms like the Times News Reader have the potential of bridging the gap between new media and old and bringing additional value to a traditional resource.

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