Mainstream Spatial Hypermedia
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ABSTRACT
Many mainstream Web pages frequently use spatial relationships in order to present their information. However, despite their demonstrated strengths for understanding, using, and analyzing information, spatial hypermedia systems are used by a relatively small user community and remain tangential to the mainstream Web. While integrating spatial hypermedia into the mainstream Web requires solving several challenges, it can improve the users’ ability to analyze, understand and use Web pages, and can help visually impaired people to interpret the structure of Web pages.

Categories and Subject Descriptors
H.5.4 [Information Interfaces and Presentation]: Hypermedia – architectures, theory, user issues

General Terms
Algorithms, Design, Theory, Standardization.

Keywords
Spatial Hypertext, Mainstream Web Pages, Research Challenges.

1. INTRODUCTION
Years of research have demonstrated that spatial hypermedia provides significant advantages for analyzing, understanding, and using information [4, 5, 7]. However, more than a decade after their inception [5], spatial hypermedia systems are still used by a relatively small user community and remain tangential to the mainstream Web. However, Web pages often use spatial relationships to present their information. This suggests that that integrating spatial hypermedia to the Web can improve the users’ ability to analyze, understand, and use mainstream Web pages. This paper identifies four challenges that need to be solved in order to accomplish this. Section 2 discusses the current state of affairs. Section 3 follows this by discussing the challenges. Section 4 culminates the discussion with the conclusions.

2. PROBLEM
Mainstream Web pages are increasingly incorporating spatial hypermedia features. For instance, news and shopping sites typically use modular layouts [6]. This design approach provides a clean and simple appearance and can package large amounts of information in a single page by using a combination of vertical and horizontal shapes. By using these shapes and other visual cues, modular layouts implicitly convey the relationships between the different information elements in the page (e.g., stories). In addition to using spatial relationships in static presentations, Web pages are increasingly adding dynamic features similar to those offered by spatial hypermedia systems. E.g., BBC News1 and Google News2 allow users to open and close sections, similarly to how users open and close collections in spatial hypermedia systems. BBC News even allows users to reorganize the page by moving sections around.

While Web pages use spatial relationships, browsers typically do not infer them or use them actively. In contrast, spatial hypermedia systems can infer spatial relationships, even as they change as the users manipulate document elements. These systems can interpret the users’ actions and aid them in their tasks [4]. However, currently there are no spatial hypermedia systems currently that handle mainstream Web pages directly. Systems such as VKB [8], Tinderbox [1], and WARP [3] do use Web features such as links, online documents, or Web browsers. However, these systems rely on standalone applications or proprietary file formats. Augmenting these or other systems to work with Web pages is a promising but challenging endeavor, as discussed in the following section.

3. CHALLENGES
Integrating spatial hypermedia to the mainstream Web requires addressing several challenges, including: establishing a theoretical foundation; defining representation standards; solving architecture issues; and modifying spatial parsers to manage Web pages.

3.1 Theoretical Foundation
In order to integrate spatial hypermedia and the Web, it will be necessary to establish a platform that supports the efforts and approaches of multiple independent researchers. To do this, it is necessary to obtain a functional definition of spatial hypermedia that guides the definition of standards and architectures.

Obtaining a functional definition with which everyone agrees can be challenging. Agreeing on what “spatial hypermedia” is – and is not – can be controversial. There are different opinions on what is intrinsic to spatial hypermedia, e.g., spatial parsers. Rather than providing such a definition here, this paper suggests devising a definition in consultation with the whole research community.

1 http://www.bbc.com
2 http://news.google.com/
3.2 Standards
In order to foster an environment where different independent researchers can operate, it is necessary to ensure a minimum level of system compatibility. However, spatial hypermedia is an active field and researchers explore different aspects and directions. Hence they often need to represent concepts that do not exist in other systems. While this complicates things, different systems can still import/export documents from/to each other (e.g., VKB can export documents to WARP). However, this approach works for specific pairs of systems, and requires continuous maintenance because, as systems evolve and change, the import/export needs to be updated. A better option is to have a common specification language that all systems can use for representing their documents or that it can be easily translated into their own format. That way, when they change their representations, they only need to update their import/export to the common language.

In addition to being flexible and extensible, a spatial hypermedia specification language must be easy to be translated to and from HTML. Like HTML, the spatial hypermedia language needs to manage the separation of content, structure and presentation. Additionally, it needs to specify spatial hypermedia functionality such as the readers’ ability to manipulate objects, the spatial parser parameters, etc. One option is to extend HTML. However, since HTML is designed to be device independent, the final document presentation is determined at runtime. This allows documents to be displayed in windows and screens of different sizes and resolutions, but it also creates challenges for spatial hypermedia given its reliance on the objects relative positioning.

3.3 Information Architecture
In order to make spatial hypermedia mainstream, it must be easy to create, publish, read, and use documents. Systems like WARP lack an authoring interface. Systems like VKB and Tinderbox provide an interface that is used for both authoring and reading. This works well for a single user/device, but a Web environment requires different architectures in order to selectively separate and configure the authoring and reading interfaces.

Ideally, a mainstream Web-based spatial hypermedia should support all the different architectures used by Web applications (client-server, proxies, plug-ins, etc.). However, the tensions between spatial hypermedia and HTML might favor some architectures over others. E.g., augmented Web browsers (or plug-ins) can parse the HTML components (including CSS and Javascript), create a final presentation, and pass it to the spatial hypermedia module/system. On the other hand, the proxy or client-server architectures might simplify distribution.

3.4 Spatial Parsers for Web Documents
Spatial parsers have played an important role on tasks such as information analysis, and structuring [2, 4]. However, they also can help users in other tasks. Parsing the space in a Web page can help visually impaired users discover the document structure and can provide them with information that is not conveyed by traditional screen readers [4, 8]. E.g., the HearSay system uses a structural parsing approach based on the HTML code to infer the spatial relationships between elements [8]. However, parsing “wild” HTML documents is hard. Not only do Web pages use of Javascript and CSS, but they often have questionable HTML. More importantly, this approach works by parsing the page at loading time. This informs users about the initial configuration, but does not support their interactions with the objects. Spatial hypermedia systems offer a better alternative by parsing the final presentation of the document. However, current spatial parsers need to be adapted to work with HTML.

4. CONCLUSIONS AND FUTURE WORK
Spatial hypermedia can be integrated into the mainstream Web realm. This endeavor requires clarifying theoretical conceptions, devising flexible system architectures, defining extensible standards, and modifying systems to work with HTML. The integration of spatial hypermedia into the mainstream Web can improve the users’ ability to analyze, understand and use Web pages, and can potentially help visually impaired users to discover and interpret the structure of mainstream Web pages. Currently we are investigating various architecture alternatives and we are working on adapting spatial parsers to work with mainstream Web documents. In the near future, we are looking forward to participate in research community efforts to establish a theoretical foundation and develop useful standards.

5. REFERENCES