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Publication Date	2009
Item record	http://hdl.handle.net/10379/4980

The 2LIP Model and Its Implementations

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ABSTRACT

In this article we present a model for 2-Layer Interface Paradigm (2LIP). 2LIP is an approach for designing simple yet interactive 3D web applications, an attempt to marry advantages of 3D experience with the advantages of the narrative structure of hypertext. The hypertext information, together with graphics, and multimedia, is presented semi-transparently on the foreground layer. It overlays the 3D representation of the information displayed in the background of the interface. We describe implementations of the 2LIP model: 2LIPGarden (HTML context) and Copernicus (wiki context). We want to show that our model can be easily employed to the existing web infrastructure.

Categories and Subject Descriptors

H.5.2 [**Information Interfaces and Presentation (HCI)**]: User Interfaces – *graphical user interfaces (GUI),* H.5.4 [**Information Interfaces and Presentation**]: Hypertext and Hypermedia.

General Terms

Design.

Keywords

2LIP, Authoring 3D Hypermedia, 2LIPGarden, Copernicus.

1. INTRODUCTION

In 1992, during the Conference on Hypertext and Hypermedia, Jay D. Bolter gave a keynote speech on Virtual Reality and the Future of Hypertext, where he described how the two can be combined [3]. This vision inspired researchers from Graz University of Technology. Andrews and Pichler in [1] examines the incorporation of three-dimensional models into hypermedia systems as fully-fledged documents. Display, navigational, and authoring aspects of 3D hypermedia documents are discussed and are illustrated with examples taken from the Harmony Viewer for the Hyper-G hypermedia information system.

Bolter's vision inspired our team as well. We work on a new way for designing interactive 3D web applications – 2-Layer Interface Paradigm (2LIP) [10]. 2LIP is an attempt to marry advantages of 3D experience with the advantages of the narrative structure of hypertext. It assumes that building graphical user interfaces involves the integration of two layers (see Figure 1): (1) the background layer is a 3D scene; (2) the foreground layer, above the 3D view is the hypertextual content, together with graphics, and multimedia (e.g., videos or other interactive 3D scenes). Hyperlinks are used for navigation in the 3D scenes (in both layers).

Figure 1. The idea behind 2LIP.

2LIP builds upon several well established techniques: *Constraint 3D Navigation* [8] (it constrains the audience's movement to interesting places – avoids the classic problem of users getting 'lost-in-cyberspace'), *Transparency* (like Harrison and colleagues [6], we found that it can improve workspace visibility without harming interaction performance), the *Focus + Context* (F+C) information visualization technique [4], *Animation* (like Bederson et al. [2], we found that animation improves users' ability to reconstruct the information space, with no penalty on task performance time), *Integration of text with visual representation* (e.g., Sonnet et al. introduce Expanding Annotations [11], the methodology to present text information adjacent to associated scene objects, where annotations expand smoothly on demand and are rendered as 2D semi-transparent polygons in screen space).

Table 1. 2LIP and DRM/AHM

| DRM/AHM	2LIP Model
Runtime Layer	Data representation in two layers
Presentation Specification	Background: 3D scene, Foreground: hypertext + multimedia (3D, video, ...)
Storage Layer	Composites (metadata + textual content with links to external resources or internal components)
Anchoring	Source anchors: parts in text Destination anchors: for 3D models – coordinates in 3D space, for video and sound–time in recording
Within-Component Layer	Resources that can be addressed by URIs

2. THE 2LIP MODEL

The 2LIP model is based on the Amsterdam Hypermedia Model (AHM) [7], which is the descendant of the Dexter Reference Model (DRM) [6]. Table 1 presents how the elements of our model are placed in the DRM and the AHM.

Figure 2 presents the three layers of the 2LIP model: *run-time* layer (it is responsible for presentation of the component to the user), *storage* layer (it models the basic node/link network structure) and *within-component* layer (it is concerned with the contents and the structure *within* the components – in our case web resources that can be addressed by URIs).

The main difference between the 2LIP model and the Dexter model is in the storage layer. As in HTML, we do not define a separate link entity. Such an approach has one obvious drawback

– users cannot create bi-directional links. However, defining links in text using inline style became established technique – even novice Internet users can create such links using HTML.
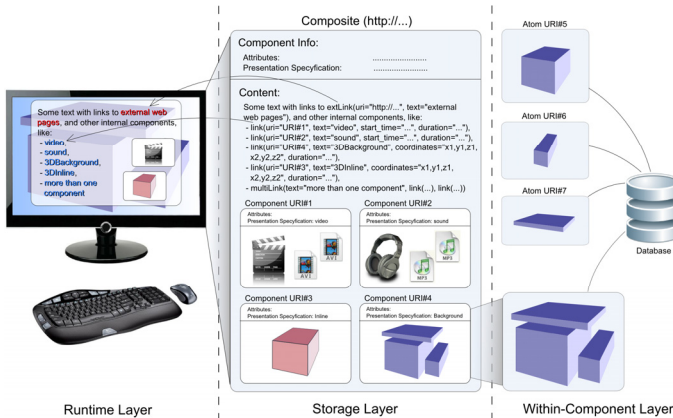
Figure 2. A depiction of the three layers of the 2LIP model (based on Dexter model).

In Figure 2, the Storage Layer contains the pseudo-code needed to render the page in the Runtime Layer. The notation of the links with uri=uri#1 and uri=uri#2 (video and sound respectively) is based on AHM. The coordinates and duration elements in the notation of the links with uri=uri#3 and uri=uri#4 define the position of the camera (x1,y1,z1), the viewpoint (x2,y2,z2), and time of the camera movement.

2.1 The Implementations of the 2LIP Model

2.1.1 2LIPGarden - 3D Hypermedia for Everyone
2LIPGarden is a 3D Hypermedia publishing framework designed to significantly lower the barrier for authoring 3D websites ([10] or visit: http://2LIPGarden.deri.ie). It enables people using predefined 3D backgrounds. Instead of writing the line:

```
<body background="/images/image_name.jpg">
```

they can simply choose a 3D scene from the list and add it to their web pages as the second layer.

2.1.2 Copernicus – 3D Social Encyclopedia
The other implementation of the 2LIP model is Copernicus ([9] or visit http://copernicus.deri.ie). It was designed to resemble Wikipedia. The difference is that any article in our system can be augmented with a 3D visualization of the information from the article (see Figure 1) and that there is a new kind of link in the articles: c-links are used for navigation in the 3D scenes.

As Wikipedia became successful because it was written collaboratively, we are also going to give users an opportunity for collaboration. We work on a content editor (see Figure 3), conceptually similar to the one from MediaWiki. The process of creating new Copernicus page consist of writing an article using a wiki markup language and composing a 3D scene from objects used on other scenes (option for *wikimaniacs*) or uploading a 3D models or scenes (option for *3D geeks*). Once the author has created the 3D scene and has written the article, the interesting places in the 3D scene may be selected and connected to the links in the text. To create such c-link the author has to switch to the free navigation mode, position the camera, and click the "get coordinates" button. After that, the system will automatically switch back to the edit mode with the coordinates in the textbox (see Figure 3a); the author can use them to create the c-link:

```
[[[c-link name|x1,y1,z1|x2,y2,z2|t]]]
```

where: (x1,y1,z1) – the position of camera, (x2,y2,z2) – the viewpoint, t – time of the camera movement. This notion is very similar to the notion of a link in the wiki markup; therefore, we hope that *wikimaniacs* and other creative internet users will have no problem with using our system.
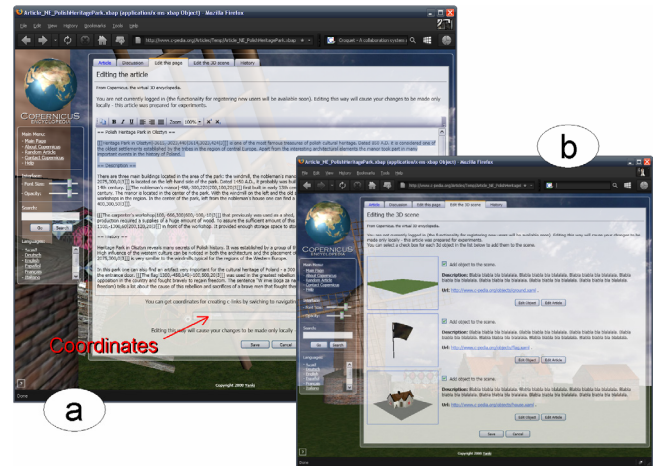
Figure 3. Authoring: (a) the text and (b) the 3D edit tab.

3. CONCLUSIONS
In this article, we have presented the 2LIP model. We aim to facilitate the creation of new generations of text that combines the advantages of 3D experience with the advantages of narrative structure of hypertext. We have described the implementations of the 2LIP model: 2LIPGarden (HTML context) and Copernicus (wiki context). We want to show that our model can be easily employed to the existing web infrastructure.

* Images and videos that illustrate the research presented in this paper, evaluation materials, implementation details, and the user guide can be found at: http://copernicus.deri.ie.

4. ACKNOWLEDGMENTS

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