TO APPEAR IN PROCEEDINGS OF VIRTUAL REALITY VIENNA '93

Constructing Cyberspace: Virtual Reality and Hypermedia

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Abstract

Large-scale, distributed hypermedia information systems allow fast, structured access to very large, dynamic information bases. The highly perceptual nature of a virtual reality interface has the power to take users both inside information and inside its structure. Combining the two takes us a step towards cyberspace, William Gibson's vision of a virtual model of all the world's interconnected data. This paper reviews current work on the boundary of virtual reality and hypermedia.

1 Introduction

Cross-fertilisation between virtual reality (VR) and hypermedia has resulted in two main application domains: "hypertextualising the space" and "spatialising the hypertext", as Jay Bolter termed them in his ECHT'92 keynote address [Bol92]. The former entails the use of navigable, three-dimensional models, certain elements of which embody hypermedia links to other related information. The latter involves generating a spatial representation of the hypermedia web itself, a kind of 3D overview map.

The use of navigable, three-dimensional models in hypermedia, though a seemingly natural extension of two-dimensional raster images or drawings, has yet to receive much attention in the hypermedia community. Jay Bolter envisages an immersive approach, "writing on the world", where textual and other information is portrayed directly in the virtual model in the form of posters, stone inscriptions, and the like. Links might be represented as some kind of flying device like a magic carpet, which whisks the reader to another location. Or maybe as a tunnel entrance, the tunnel leading to a new location, or a "magic window" into another world (which has the advantage of giving some kind of preview as to where one would go).

Here in Graz, we have implemented a "through-the-window" approach, where three-dimensional models are considered to be hypermedia documents in their own right and are viewed through a window on the computer screen; pieces of textual or other information being presented in windows of their own.

Graphical browsers and overview maps for hypermedia systems already exist in two dimensions, although their automatic generation (as opposed to hand-crafted) poses non-trivial problems, particularly in the area of automatic graph layout. Work on extending the idea to three dimensions is still at the research stage. However, the possibilities offered are very attractive: for example a 3D overview map where pieces of information are represented as shapes in 3-space, with links strung as cables between them and clusters representing related data.

2 Hypermedia and Deep Hyperspace

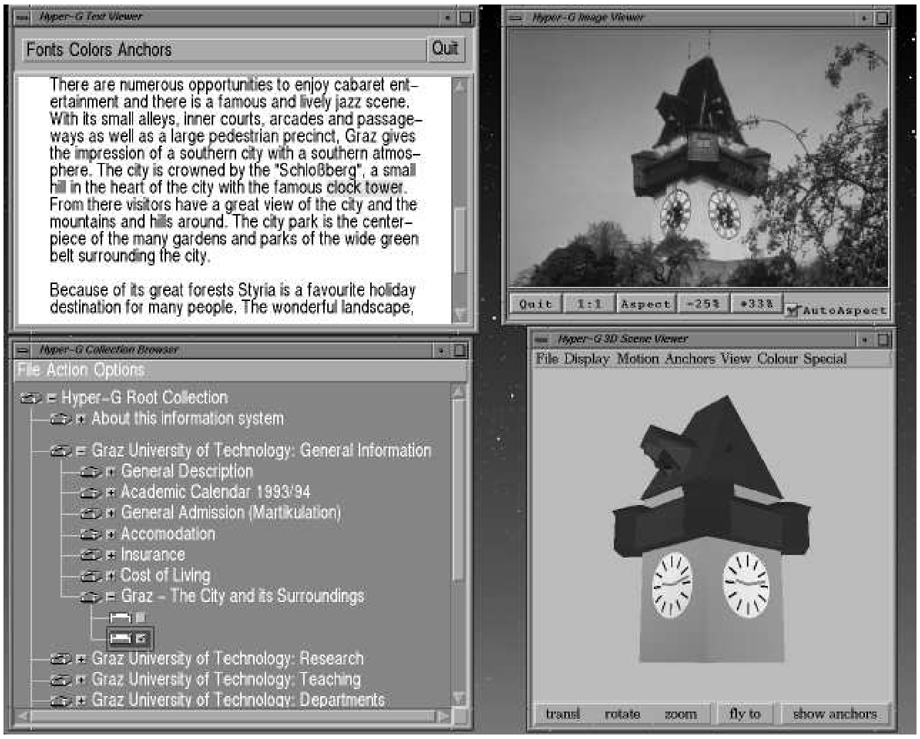
Hypertext is non-linear text. Unlike the typical printed book, which is read sequentially from beginning to end, a hypertext comprises many interlinked chunks of text. Readers are not bound to a particular sequence, but can browse through the information naturally by association, following their interests by clicking on highlighted keywords in one text to bring up another associated chunk of text. Hypermedia is the generalisation of hypertext to include all kinds of media (images, drawings, sound, film clips, 3D models, etc.) as well as text. The individual chunks of information are usually referred to as *documents* or *nodes*, and the connections between them as *links*. [Nie90] and [BD91] are good introductory texts on hypertext and hypermedia.

One of the main problems in hypermedia systems is that of user disorientation, becoming "lost in hyperspace", first discussed by [EH89]. The symptoms are: the difficulty of gaining an overview, finding information again, not knowing how much information there is on a subject and how much of it has already been seen, not knowing whether everything important has been seen, etc. To help users orient themselves in the information space, most hypermedia systems provide one or more navigational aids:

- **Guided Tours**. Predefined (mostly linear) paths through hyperspace.
- **Search Facilities**. Keyword search, full text search, fuzzy search (with errors), similarity measures [Sal89].
- **Visual Overviews**. Manually crafted drawings, maps, annotated photographs, etc.
- **Graphical Browsers**. Automatically generated structure maps [UY89]:
    - global map (entire hyperspace)
    - local map (around current node)
    - fisheye view (magnifying glass around current focus)
    - automatic clustering
    - hierarchical browser.
- **Backtracking**. Return to previous node, history list, bookmarks.

Most current hypermedia systems are frame-based, stand-alone, single-user systems (e.g. HyperCard [Goo87] and ToolBook [Cor89]). Documents must fit into a fixed-size frame (screen) and authors have full control over both their content and presentation.

Hypermedia information systems, on the other hand, are typically window-based, distributed, multi-user systems (e.g. Intermedia [HKRC92], Hyper-G [KMS93, KM93], and WorldWideWeb [BCGP92]). Documents may be any size, each displayed in its own (scrollable) window. Authors specify only the information content of documents, style sheets control their presentation (see [AK93, SKA93]).



There are numerous opportunities to enjoy cabaret entertainment and there is a famous and lively jazz scene. With its small alleys, inner courts, arcades and passageways as well as a large pedestrian precinct, Graz gives the impression of a southern city with a southern atmosphere. The city is crowned by the "Schloßberg", a small hill in the heart of the city with the famous clock tower. From there visitors have a great view of the city and the mountains and hills around. The city park is the centerpiece of the many gardens and parks of the wide green belt surrounding the city.

Because of its great forests Styria is a favourite holiday destination for many people. The wonderful landscape,

- Hyper-G Root Collection
  - About this information system
  - Graz University of Technology: General Information
    - General Description
    - Academic Calendar 1993/94
    - General Admission (Martikulation)
    - Accomodation
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    - Graz - The City and its Surroundings
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Figure 1: Harmony: The Hyper-G Browser for X Windows

Hyper-G is an ambitious, large-scale hypermedia project currently underway at Graz University of Technology. Figure 1 shows Harmony [AKJ94], the Hyper-G browser for X Windows. Harmony's collection (hierarchical) browser, text viewer, image viewer, and 3D viewer are visible.