# A Navigation Path Planning on the Web

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## Abstract

*The main issue addressed in this paper is how to help learners navigate in existing web-based learning resources. Our approach to this issue is to provide learners with a space, in which they can see through WWW pages to plan a navigation path in a learner-centered way. In this paper, we describe an assistant system for the navigation path planning, which is composed of hyperspace map, page previewer, and path previewer. The page previewer generates an overview of each WWW page in the map by extracting representative information from the HTML file. The path previewer helps learners make a sequence of the pages previewed as navigation path plan. These facilities help learners decide which page to visit and plan a navigation path without visiting hyperspace.*

## 1. Introduction

Existing learning resources on the Web generally provide learners with hyperspace where they can explore the WWW pages by following the links among the pages to achieve a learning purpose. However, learners often fail in making the navigation path since they cannot foresee what they can explore from the current page and cannot decide which link to follow for achieving their learning purpose [3]. This is caused by the complexity of hyperspace. They may alternatively reach an impasse due to a cognitive overload, which is caused by diverse cognitive efforts at setting up local learning purposes, comprehending the contents included in nodes, etc., in the exploratory learning [3]. Such problem of how to facilitate learners navigation is also a major issue in educational hypermedia/hypertext systems [1], [3].

Current work on educational hypermedia/hypertext systems has provided a number of navigational aids such as spatial/concept maps and adaptive navigation [1], [2]. However, these aids can not be always available to existing learning resources on the Web since it is hard to identify semantic relationships among the WWW pages, on which the aids need to be founded, without analyzing the contents of the learning resources. Although there are web-based learning resources with site maps, in addition, the anchors included in the maps do not always allow learners to foresee the contents of the WWW pages.

In order to resolve these problems, this paper proposes a learner-centered navigation path planning whose key idea is to provide learners with a space where they can see through existing web-based learning resources to plan a navigation path. This paper also introduces an assistant system including new facilities called page previewer and path previewer.

## 2. Learner-Centered Navigation Path Planning

### 2.1. Planning and Exploration

Let us first introduce the learner-centered navigation path planning. Apart from hyperspace, learners have a space for making a navigation path plan with an overview of each WWW page. In the planning space, learners decide which page to visit and the sequence of pages visited. In the hyperspace, they are expected to explore hyperspace as planned. The navigation path planning and the plan execution are repeated during learning in hyperspace.

The distinction between navigation path planning and plan execution allows learners to focus mainly on comprehending the contents of learning resources in hyperspace. Since the navigation path plan also gives learners an overview of the contents to be learned before exploring hyperspace, their learning can be improved.

### 2.2. Framework

Demonstrating the assistant system, let us next discuss how to support the navigation path planning. Spatial maps of web-based learning resources are necessary for considering navigation paths. However, the maps alone may be insufficient for learners to decide which page to visit because of the insufficiency of information about nodes (WWW pages) included in the maps. It is indispensable to provide them with some additional information. However, planning with the full contents of the WWW pages causes the same navigation problem as hyperspace usually produces. This suggests the necessity to give learners an informative overview of the contents. We accordingly introduce a page previewer that extracts keywords, sentences, or images to be considered representative from a WWW page to display them as the preview of the page.

In addition, the navigation path planning involves considering the relationships between WWW pages explored, changing the plan, and replanning over again. We accordingly introduce a path previewer that makes a sequence of the previewed pages the learners want to visit.

Figure 1 shows a user interface of the assistant system. The system is composed of spatial map, page previewer, and path previewer. The spatial map represents hyperspace of an existing web-based learning resource selected by learners as network of nodes corresponding to the WWW pages, which is automatically generated and displayed in the map window. The nodes are tagged with page titles indicated by title tags in the HTML files. The spatial map represents the WWW
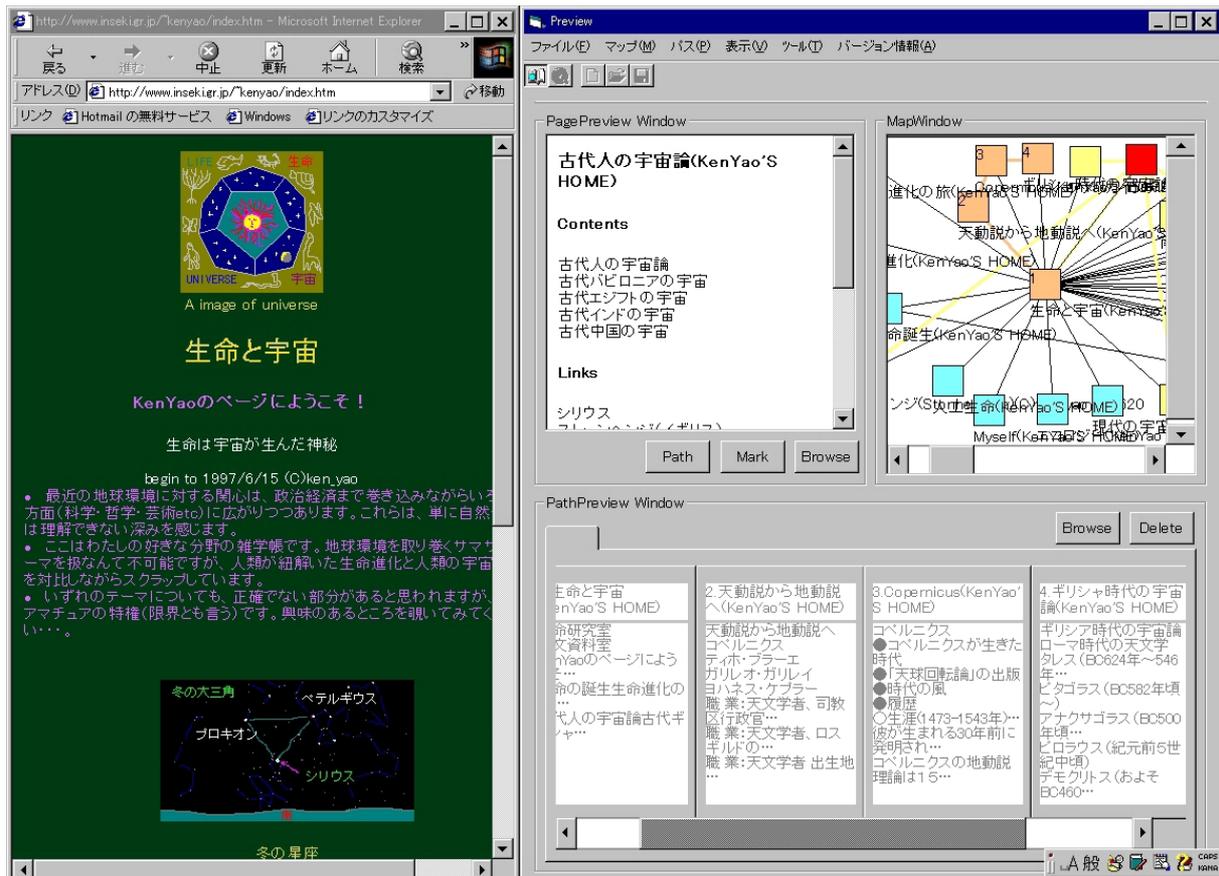
**Figure 1.** User interface.

pages only within the same WWW site where the homepage selected by the learners is located.

In the spatial map, the node corresponding to the WWW page learners currently visit with browser is colored with red. The learners can start planning a navigation path from the current node by following the links. The path planned is restricted by the structure of the spatial map. In left mouse-clicking a node, they can have an overview of the WWW page corresponding to the clicked node in the page preview window. The page previewer extracts information attached to some HTML tags in the HTML file, which are considered representative. If they can not foresee the contents of the page, they can push the Browse button under the page preview window or double-click the node to look at the full contents in browser. The learners can also include the node previewed in the path preview window by pushing the Path button, making a navigation path plan.

In the path preview window, the path previewer sequences the nodes previewed, which nodes are put in order by learners. The order of the previewed nodes represents a navigation path plan.

The learners are expected to explore hyperspace as planned with browser. However, they do not always need to follow the plan. In this case, the path previewer put a warning icon on the node at which the learners run off in the plan. When they also want to change or cancel the navigation plan during the exploration, they can return to the navigation path planning windows and remake a new plan.

## 3. Conclusion

This paper has proposed a learner-centered navigation path planning on the Web for learning with existing web-based resources. The important point is to provide learners with a space where they can see through WWW pages to make a navigation path plan before exploring hyperspace. This paper has also demonstrated an assistant system including page previewer and path previewer. These previewers allow learners to decide which page to visit and make a navigation path plan without visiting hyperspace.

We have already done a preliminary evaluation. The results indicate that the system produces good effects on learning and navigation in a complicated hyperspace. In the future, we need a more detailed evaluation of the navigation path planning. We would also like to provide more adaptive aids in the page and path previews.

## 4. References

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