Running Out of Space: Models of Information Navigation

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1 Introduction

This short paper reflects recent concerns with the models on which we base navigation mechanisms for information spaces. As we are daily presented with new sources of on-line information in a variety of areas, and as these are increasingly interconnected into a large web of electronic information, it becomes necessary to investigate the means by which these information sources are structured. Architects have long understood the relationship between the structure of space and the interactions it can support, and much the same holds true of information structures.

Our particular concern here is the use of spatial models of navigation. The spatial metaphor has been a rich source of organisational principles in a variety of information systems [1, 4, 5]. To avoid a certain amount of confusion, we want to focus on the issues of *navigation*—that is, the means by which a user can describe movement between pieces of information—rather than simply layout. In the end, most information must be laid out spatially; it is navigation that is at issue here.

2 Semantic Navigation

Spatial models of navigation have been used particularly in *virtual reality* systems, but spatial organisation of data has been a highly visible component of a number of information systems. The role of the spatial analogy is clear, and in particular it exploits our familiarity with the naturally spatial organisation of the real world. Indeed, it's the notion of spatial arrangements which encourages (and legitimises) the notion of navigation of information systems. However, in navigation (as opposed to organisation), this use of the "spatial" is a convenient gloss for a different organisation, which we refer to here as "semantic".

So, there are two main areas of application for spatial models of information. The first is the *inherently spatial*, which is most obviously seen, for instance, in computer-based maps of physical spaces. The second, and more common, is where an underlying *semantic* relationship between information objects is mapped onto a spatial arrangement. Systems which group objects according to similarity, or which exploit some other aspect of the underlying information and render these relationships as spatial dimensions are employing this link. In these systems, we observe not purely spatial navigation, but semantic navigation which is performed in spatial terms. What is gained here is a naturalness of use based on the everyday familiarity of the physical environment. We gain the ability to explore and choose perspectives of view based on knowledge of the semantically–structured information.

Semantic navigation is also clearly valuable in information systems not based on spatial models. In hypertext systems, for instance, the primary form of navigation is semantic—in particular, associated with the (domain-dependent) semantic properties of various links. It's not uncommon to add a spatial representation to these systems, although typically these model not so much properties of the information as properties of a user's "route" through it. In spatial navigation, a user will move from one item to another because of a spatial relationship—*above, below, outside*. In semantic navigation, this movement is performed because of a semantic relationship—*bigger, alike, faster*—even when that relationship is expressed through a spatial mapping.

3 Social Navigation

When navigable information systems are extended to support collaborative activity, a third model of navigation arises. This is *social* navigation. In social navigation, movement from one item to another is provoked as an artefact of the activity of another or a group of others. So, moving "towards" a cluster of other people, or selecting objects because others have been examining them would both be examples of social navigation.

Although most virtual reality systems allow several people to interact, little or no direct support for emergent collaborative behaviour has been evinced. This may occur indirectly as a result of an awareness on the part of individuals about the visible actions of others and of groups. The DIVE system does try to address some of the problems of relying on purely visual and aural awareness by means of its spatial model of interaction [2]. The role of this understanding or awareness has been pointed to in a number of other domains, and it is clearly of great value in a collaborative information system, even where the activities performed within that system are largely self-contained and individual.

Clearly, in those systems, the social navigation is embedded in a spatial framework. The decision that some information might be interesting as a result of seeing the clustering of like-minded individuals around it is clearly exploiting a familiar real-world situation and is based on the use of space. However, one reason to separate out social navigation from spatial is that, in a similar way to the semantic navigation of hypertext systems, we can observe social navigation taking place in non-spatially-organised information environments.

One particular example of this has arisen particularly over the last year or so along with the explosive growth of the World Wide Web (WWW). WWW is a system supporting distributed hypermedia documents across the internet, extending a simple document model with hypertext links which can point to documents on other machines across the network. In addition to all sorts of information, from the CIA World Fact Book, through searchable movie databases to on-line journals, a common feature at WWW sites is a set of "home pages" of information for individuals located there. With increasing frequency, these pages contain a list of hypertext to "WWW places I find interesting". Here, then, there is a model in which the opportunity to explore information is based not on either location or content, but rather on recommendation and social factors.

A second example within a more formal structure is the use of "collaborative filtering" in systems such as Tapestry [3]. Collaborative filtering is a mechanism for managing information such as electronic mail or USENET news articles. Firstly, it provides a means for individuals to "vote" on articles they read, indicating interest; and secondly it provides means for readers to issue queries such as "show me today's most popular articles", "show me articles Bob and Joe have found interesting", or "show me articles which were marked as being interesting to people who found this one interesting". In the sparsely-connected space of electronic message systems, collaborative filtering provides a means to exploit social knowledge to navigate around items of interest.

4 Addressing the Separation

What do we gain from the distinction between spatial, semantic and social navigation? We believe the most important benefit is a means to understand the value of various interactive models in information spaces. We believe it is important to appreciate the ways in which these different navigation techniques are employed, and that this can provide a means to address some problems with purely spatial models.

For instance, consider collaborative VR-based information systems (*i.e.* those which augment a VR-style spatial layout of information with collaborative access and awareness). One problem with these is the tension between two goals. On the one hand, the designers of these systems would like to exploit the computational power behind their visualisations to support the tailoring and reconfiguration of the space, allowing a user to organise the information appropriately for their individual tasks and activities, as well as to filter out information which they are not interested in at particular times. On the other hand, in order to exploit the awareness of others' ongoing activities which can be provided in a collaborative space, it's important to maintain a common orientation to data and a common structure to the space in which interactions take place.

The root of the problem, then, is that the notion of awareness and the value of awareness information for navigation is rooted in the spatial model; that is, that social navigation is seen as being a particular form of spatial navigation when it takes place in a spatially-organised environment. The experiences of social navigation in WWW or in Tapestry point to the way in which social navigation can be effective in information environments organised on non-spatial lines. The observation that the valuable information in a spatially-organised system may not be directly spatial at all leads us to look for the ways in which we can design more explicitly around semantic and social navigation techniques.

This move away from the spatial model—or rather, a reappraisal of its actual value—can help, perhaps, in moving away from some of the restrictions of spatial organisation. One problem with the physical dimensions, which are the only basis of separation in spatial models, is precisely that they *are* dimensions—geometric, absolute, orthogonal. We must either restrict our choice of information dimensions to those which share those properties, or build a system in which spatial discontinuities or inconsistencies will arise. This is problematic when semantic and social navigation are seen only to take place as a result of spatial organisation. In realising where navigation is actually semantic or social in origin, we can avoid geometrically–based constraints to which spatial models are subject.

5 Conclusion

We have separated three forms of navigation mechanism which are commonly combined in information systems — spatial, semantic and social. The spatial model provides a good infrastructure to build on, but we should consider how semantic structure aids the individual in navigation and orientation, and how it forms a basis for many means of social interaction. The three types of navigation are distinct yet collectively interlink the issues of form and use.

We should not rush towards using spatial models, nor should we shun them completely. Instead, by understanding what features of navigation and use arise in each case, and how structure, navigation and collaboration are interlinked, the designer can make a more informed decision as to what elements of spatial and non-spatial information systems are appropriate to the goals and activities of the eventual users.

References

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