

EXHIBIT 8



Workspace: A Scriptable Document Management Environment

Peter Lucas, Lauren Schneider
 MAYA Design Group
 Suite 702
 2100 Wharton Street
 Pittsburgh, PA 15203, USA
 Tel: 412-488-2900
 Email: lucas@maya.com

ABSTRACT

Workspace™ is a prototype office document management system designed to break the barriers between various types of electronic documents. It provides users with a common user interface for direct and scripted manipulation of information of heterogeneous forms and from diverse sources. Workspace is comprised of a client/server architecture, a three-dimensional direct manipulation interface, and an asynchronous scripting environment. The system provides a platform for the cost-effective development of highly customized applications in many task domains.

KEYWORDS: Document management, three dimensional interface, unifying data sources, objectification, scriptability.

INTRODUCTION

Once, nearly all office documents resided on paper. Increasingly, however, routine business information now exists in the form of computer databases, email, faxes, scanned images, and other electronic documents. There are good computer tools for dealing with each of these, but the grouping and coordination of information from multiple sources remains a problem.

Workspace is a prototype office document management product that represents an effort to regain the simplicity and consistency of paper documents in the context of the computer-based office.

Workspace was commissioned by Digital Equipment Corporation and developed at MAYA Design Group in collaboration with Digital's engineering staff.

Permission to copy without fee all or part of this material is granted provided that the copies are not made or distributed for direct commercial advantage, the ACM copyright notice and the title of the publication and its date appear, and notice is given that copying is by permission of the Association for Computing Machinery. To copy otherwise, or to republish, requires a fee and/or specific permission.

CHI94 Companion-4/94 Boston, Massachusetts USA
 © 1994 ACM 0-89791-651-4/94/0009...\$3.50

™ Workspace is a trademark of Digital Equipment Corporation.

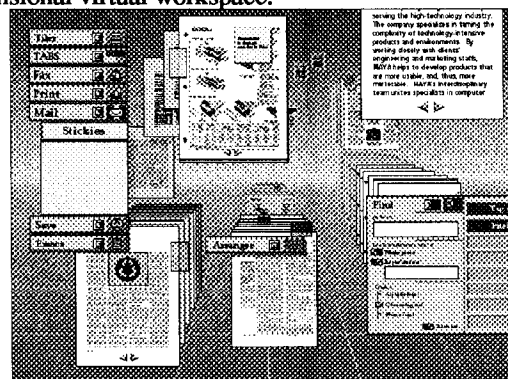
FIELD RESEARCH

MAYA conducted some early field studies of workplace environments in which such a product might be used. The goal was to broaden our understanding of how office workers organize their work spaces to support the access, storage, and retrieval of information. Workspace's ability to facilitate information manipulation and fit into existing environments depended on accurate insights about real workers and their work spaces.

Several robust findings emerged from these studies:

1. Our subjects made extensive use of spatial arrangements of paper as a device for short-term storage and organization of documents. For many users, piles of documents were the dominant means of organizing their world.
2. We observed many instances of the extensive use of Post-it™ Notes as a medium for capturing, arranging, and sharing small chunks of information, often in creative ways. A key advantage of this medium appeared to be its flexibility and modularity for the manipulation of small units of information.

The Workspace interface directly reflects these concepts of information modularity and spatial organization. This metaphor contains a single uniform object type, called simply a "document". Documents are represented to the user as two-dimensional objects rendered in a three-dimensional virtual workspace.





ARCHITECTURE

Workspace employs a client-server model between a user-application, known as the "viewer", and any number of networked data repositories. The viewer receives documents from repositories and renders them in the user's workspace.

The interface defines a small number of primitive user operations: dragging a document in its X-Y plane; dragging in the Z dimension to move the document closer or farther in the three-dimensional workspace; and "clipping" in a document's edges to allow the user to make it smaller while still being able to read it.

OPTIMIZING INFORMATION ACCESS

The Workspace interface was designed to significantly increase the bandwidth between users and the information in documents while maintaining the rich cues available in the non-electronic environment.

We accomplish this in several ways:

1. Workspace permits the viewing of large numbers of documents simultaneously in meaningful spatial configurations. As our field studies showed, the physical location of documents (and their spatial relationships) are very powerful cues for retrieval. One of our subjects expressed this strongly: "Where it is is what it is".

Workspace permits piles, tiles, etc. of documents to be both directly manipulated by users, and constructed and processed by scripted tools. The result has a kind of a "scientific visualization" character to it.

2. Workspace provides a medium in which users can capitalize on pragmatic and incidental cues for retrieval. "I left it over there". "It had a photograph in the lower right corner of the first page". "I jotted that down on a tiny sticky note".

Workspace's non-modal "documents-always-open" interface paradigm lets users see at a glance many things about documents which would be invisible in a traditional interface. I can see that one document is a scanned image, another contains tabular data, and a third is two-column text, even when the documents are too far away to read. I can just *see* this, I don't have to ask.

3. It is easy to casually put "markers" on documents or groups of documents. Workspace provides yellow stickies, colored tabs, and the ability to group documents into piles and tiles to support maintaining collections of documents.

SCRIPTING FOR POWERFUL CUSTOMIZATION

The Workspace interface itself really doesn't do much. Its only job is to synthesize a "space" in which documents can

be fetched, displayed, and manipulated. In this sense, Workspace is less an application and more a medium for the management of a universe of diverse documents.

Workspace's real power is in allowing users to script tools to manipulate documents. By providing a scripting environment with significant versatility for the power user that is also accessible to the average user, the interface supports the development of highly-customized applications that are far too specific to be supported by shrink-wrapped applications. Workspace aspires to do for processing documents what spreadsheets did for processing numbers.

In the context of shared data repositories, Workspace's scripting environment provides the basis for powerful collaborative work solutions and agency. For example, I can easily write a tool which runs all day, searching various data repositories for new information matching certain search criteria, gathers matching documents into a pile in my workspace, tags especially interesting ones with colored tags, forward certain ones to other users, etc.

ASYNCHRONY FOR EFFICIENT ACCESS

Because Workspace aspires to deal with multiple heterogeneous data sources, and since some of those data sources are likely to have intrinsically slow performance, it is essential that the interface be completely asynchronous. Workspace has no busy cursor. Individual tools can be busy for long periods, even continuously, but the interface is designed never to block. I can always deal with other documents and use other tools while a long operation is pending. This requirement presented a number of technical challenges related to multi-threaded scripting, interaction between scripts and client-server transactions, and client-side caching.

CONCLUSION

Although the design focus of the Workspace prototype was office document management, its interface paradigm is quite general. Workspace is less an application than it is a medium for retrieving information objects and writing scripted applications to manipulate them. The uniform object types, the three-dimensional workspace metaphor, and a powerful scripting language provide a rich environment for the cost-effective development of highly customized applications in many task domains.

ACKNOWLEDGMENTS

The work presented in this demonstration reflects the collaborative efforts of many people, including Joe Ballay, Andy Brown, Hugo Cheng, Glenn Hoffman, Rashi Khanna, John McDermott, Jim Morris, Nick Sabadosh, Jeff Senn, Diane Stidle, and Dean Thompson.