Three Fundamental Elements of Visual Rhetoric in Hypertext

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Introduction

The design of information on the printed page or on the computer screen must express the overall structure of that information in order to be understood by the reader. Various conventions of typography communicate the meta-structure of a block of text such as size of type, weight of font, use of indents, initial capitals (derived from illuminated capitals in the manuscript tradition), use of bold and italic variations, and use of color. Analogous conventions exist in information graphics for communicating quantitative information, visual narrative such as instructions, and location graphics such as maps.

Hypertext adds a new element to visual communication by requiring the identification and traversal of links. This new element must either share in the established visual conventions or it must be conveyed through the creation a new visual language. This apparent polarity is not a simple either/or proposition. In practice, the design of each hypertext system must establish the appropriate mix of convention and innovation.

There are three elements that should be communicated in any hypertext system. These three fundamental elements are:

- link presence (which must include link extent),
- link destination (which must include multiple destinations),
- link mapping (which must display link and node relationships).

This paper will briefly report the visual methods for conveying this visual rhetoric available in two hypertext systems, Intermedia and Storyspace, used for developing educational hypertext materials at Brown University. These methods will be evaluated and criticized.

Link Presence

Intermedia: Intermedia used a single glyph to represent the presence of a link in all types of data: text, graphics, animation, and video. This simple method was successful largely because Intermedia supported a single type of link behavior: following a link always opened the destination document window and highlighted the link extent.

Marking the link extent was supported by reusing two Macintosh conventions: highlighting text with a flashing marquee and graphics with gray "handles" [see Haan 1992 for examples]. This highlighting was presented upon arrival when following a link, and when explicitly requested by the user on an anchor basis.

These design decisions were made to simplify the user interface. It was argued by the initial development team that different glyphs for different types or numbers of link destinations were unnecessary [Garrett 86]. The trade-off between supporting a complex visual code to differentiate link typing versus the simplicity of a single visual link representation is important to consider. It becomes important to distinguish among different link types only if links behave in significantly different ways or if a property of the link destination such as quality or quantity must be indicated. We have found this to be true based on our experience with systems such as HyperCard and *DynaText* which support a variety of link behaviors.

For example, the design of SGML Tutorial [van Herwijnen 93], a *DynaText* version of Practical SGML [van Herwijnen 90], required ten distinct icons or color treatments of text elements to distinguish a variety of link behaviors. In

this hypertext following a link could perform such dissimilar events as open a graphic, run a parser on a text file, or scroll the reader's view to another location in the same book.

In addition to its simplicity, the use of a single glyph in Intermedia provided a visual "thing" with which the user could interact when editing links themselves as opposed to link content. Intermedia was a non-modal authoring and reading environment, which required the links to have a single appearance whether they were being followed, created, or modified. With the link glyph selected, the user could follow the link, add more links, push or pull data across the link, or delete the link.

However, this glyph was treated differently in different application data structures. In the graphics editor the visual connection between the glyph and the linked object or objects was entirely arbitrary, since the glyph could be moved independent of the link content. In the text editor, however, the glyph was locked in position above the first character of the link extent.

The search for the best way to represent a link marker in text is worth recounting in some detail. In Intermedia 1.0 this glyph appeared over the first character of the word being linked, often obscuring the word. Authors responded by adding a blank space at the beginning of each link in text to make room for the link marker. In Intermedia 3.0 the glyph was placed above, rather than on top of, the first character. This strategy was less destructive to legibility of the word being marked but disrupted the structure of the text itself by creating additional line spacing wherever a link occurred.

Intermedia displayed anchor extents in the current document one at a time, at the user's request. This minimized the visual disruption that displaying the marquees or handles might cause, but proved to be too subtle when links were promoted to first-class objects. As part of the development of InterNote in Intermedia 4.0, support for copying, pasting, and resizing of link extent was added [Catlin 89]. This made highlighting the link extent more important. The interface for highlighting link extent was modified to support highlighting on link selection in addition to highlighting on arrival at a link destination.

Storyspace: Links in Storyspace are directional — incoming (those that point to the current space) and outgoing (those that point to other spaces). When a link is followed, the destination link extent is highlighted using the standard text highlight color. There is no visual cue to convey presence of outgoing links when a space is opened. To see these outgoing link extents, the user must hold down a two-key combination on the Macintosh keyboard (Option+Command). When these keys are depressed, a single-pixel box is drawn around the text where links originate. Links from graphics are handled in a similar manner, since graphics are treated as text "characters" in Storyspace.

This lack of a visual rhetoric to identify link presence has lead some authors to impose their own conventions, such as using bold type, to convey the presence of links in text to the reader. This design decision also requires users to operate indirectly when following links: the user must first place the cursor somewhere in the invisible link extent and then move the mouse to click on the "link follow" icon in a button matrix.

The use of a solid box to mark links decreases the legibility of type within the box. In contrast, the use of gray underlining to mark link presence in various HyperCard applications designed by The Voyager Company and Apple

Computer presents a similar solution without decreasing legibility [Kahn 93]. However, Storyspace marks link presence in a transitory fashion (the box appears only when the user holds down certain keys) and so the box's effect on legibility is minimal.

In Figure 1a and 1b we have tried to enumerate various methods for marking link presence within a block of text. The variables are: use of line around text, use of background color or pattern, and use of foreground color in type. The method chosen for any specific system must balance the clarity of the marking against the imposition of the mark upon the legibility of the text block. Frequency of marking should also be an important consideration, as well as support for nested and/or overlapping marks.

Figure 1a
Variations of bracketing, underlining, boxing, and partial boxing of linked words and phrases

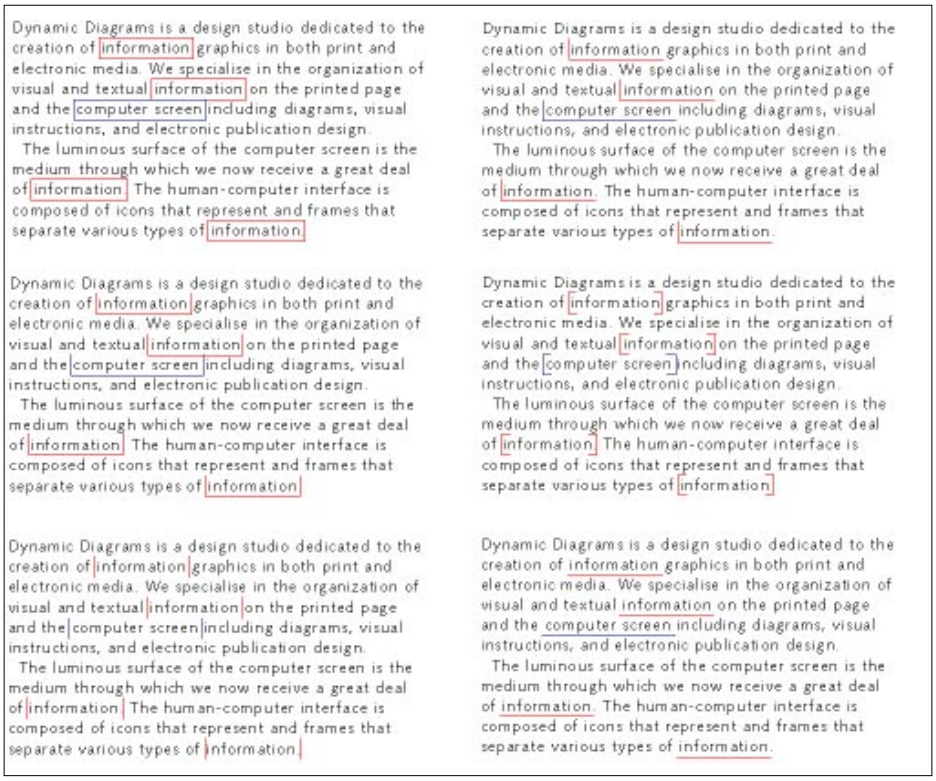
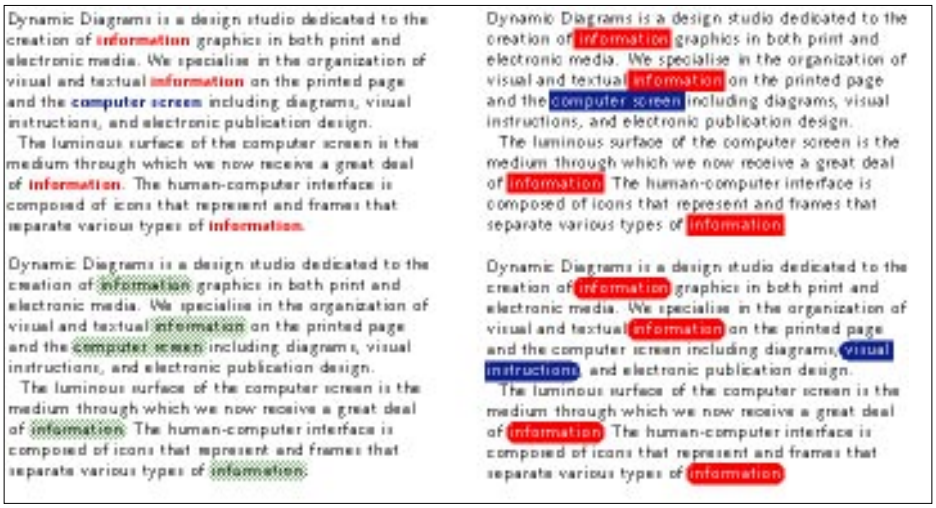


Figure 1b
Use of bold, background color, and background stripes with hard and rounded corners



Link Destination

The two proto-hypertext links we are all familiar with in scholarly literature are the footnote and inline citation. Both of these conventions from print point from the text on the page to another location in the current document or in "the literature". The footnote, whether it is a superscript number or non-verbal typographic marks such as the asterisk or dagger, provides an index into a list of related information elsewhere on the page or at the end of a logical section. The inline citation provides the reader with at least an abbreviated name for the destination it points at. In either case the reader is provided with a clue as to the destination before "leaving" the narrative on the page.

The facilities for marking and previewing links in Intermedia provided some clue to the reader about a link's destination in the form of document name, document type, and anchor explainer. Selecting the marker for a link in a document would highlight the navigational possibilities from that link in the Web View's local map elsewhere on the screen. This would give the reader the document name and data type that contained possible destinations. If the link had multiple destinations, double-clicking on the marker would present a modal dialog box listing the names of documents and explainers for each destination anchor. The dialog appears in a uniform location on the screen unrelated to the link marker selected. The reader then had to choose one destination in order to continue navigation.

This Web View was intended to provide orientation and context for the reader as she navigated through the hypertext web [Utting 89]. The representation of link destinations did not indicate the place of a document in the folder hierarchy. So, for example, previewing a link and seeing in the Web View that it might lead to graphic document called "Portrait" gave no indication of who the graphic might be a portrait of, though this information might be implied in the name of the folder in which the document resided. The reader also could not see what, other than the current document, the destination document might be linked to. Other features of this map will be discussed below.

Storyspace provides a subset of this same link destination information. A reader selecting a link with a single destination get no information about the possible destination before navigation occurs. Following a link with multiple destinations presents a dialog box listing the names of destination spaces. Figures comparing multiple link destinations in Intermedia and Storyspace are found in [Landow 92].

We think the reader should be able to preview possible destinations before following a hypertext link. We recognize that there is sometimes a specific value to leaping blindly into hyperspace in works of hypertext fiction, but this is more the exception than the rule. We also think that this preview should appear in the context of the link source, which is to say visual related to it.

We suggest that previewing of link destination appear to the reader as a visual extension of the link presence. Selecting a link should reveal this additional information in a form that does not move the reader from his point of focus. This can be done by having a representation of the possible link destination(s) appear immediately above or below the link source. Coordinating this representation of the possible link destination with a contextual representation in a link map is an important feature discussed below.

Link Mapping

Much has been made of the potential dangers of a reader becoming lost when navigating in a hypertext. Conklin's oft-cited survey article [Conklin 87] postulates this problem, though he neither proves or rigorously defines what is meant by being "lost in hyperspace."

The reader of a hypertext is often likened to a traveler through a physical landscape. A goal-oriented traveler becomes lost when she loses sight of her goal or her path to that goal. A traveler with no specific goal in mind becomes lost when he no longer perceives where he is in relation to a known landmark, such as where he came from. However, when we say a mental traveler has become "lost in thought" we mean nothing pejorative by it. Rather such a person has become completely involved or absorbed by an idea, a mental state many educators wish they could instill in their students. We have tried to take into consideration this variety of reactions to the non-linear and multi-directional nature of hypertext content in our studies of readers' reaction to educational hypertext [Kahn 92].

A spatial representation of the connections in a hypertext is a critical support for hypertext navigation whether we want to reader to become completely absorbed or be led along a constrained path.

The shape this map can take is largely dependent on the linking model of the system. The Xerox NoteCards system could generate a binary tree graph to show links emanating from any "root" node [Halasz 87]. This map became very wide and visually difficult to manage. However, it provided the reader with both a sense of how nodes were connected and an alternate method of navigation.

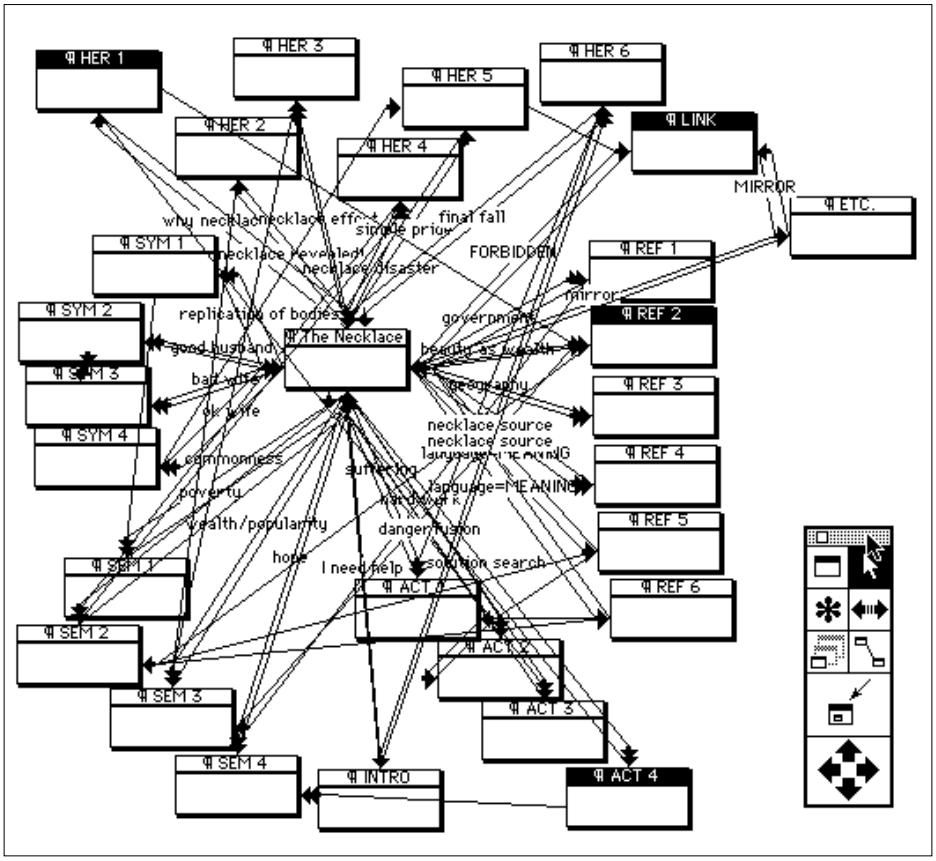
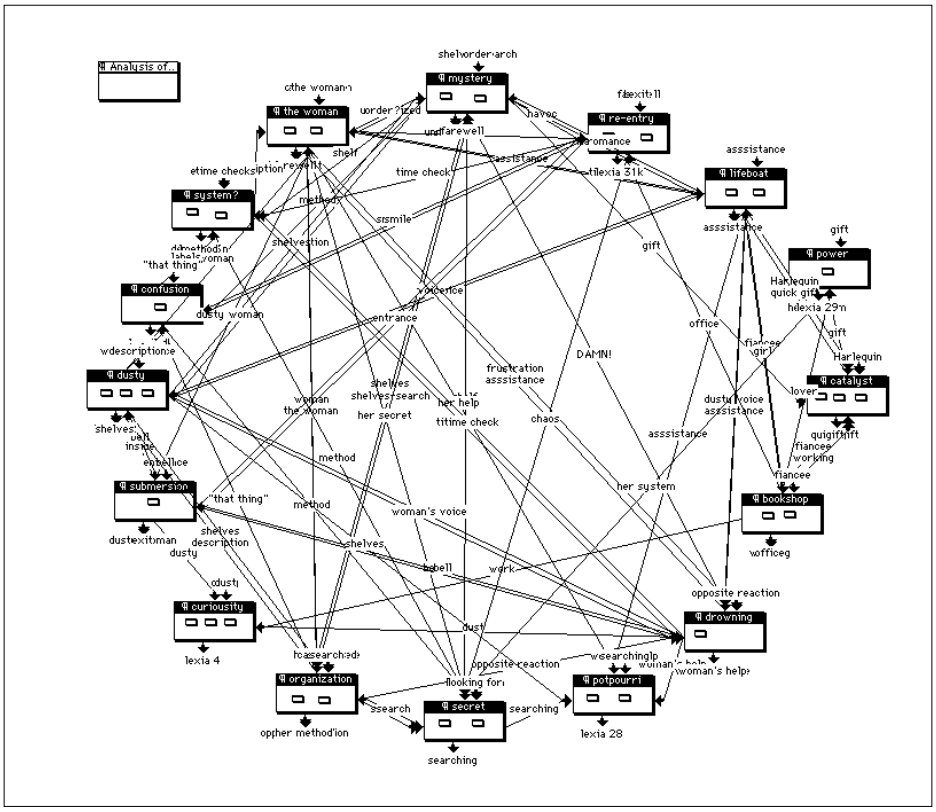


Figure 2a
A Storyspace Web representing a hypertext treatment of de Maupassant's "The Necklace," from Landow's Hypertext and Literary Theory Class, Spring 1993

Figure 2b
A Storyspace Web emphasizing the circular relationship among spaces along with crossing paths from Landow's Hypertext and Literary Theory class, Spring 1993



The Intermedia Web View was limited to a nearest-neighbor map with no indication of directionality or hierarchy relationships between documents. In addition to the support for preview functions mentioned above, the Web View also provided navigation support. This was expected to compliment and coexist with, rather than replace, the desktop folder system which organized documents into hierarchies.

Storyspace represents an entire "web" at the Macintosh desktop level as a single document. In the Storyspace view the reader gets a view of both the links and hierarchical relationships of all the spaces in the web. However, this view provides a preview of possible link destinations only between spaces within a single space (e.g. at the same level of the hierarchy).

Several students in George Landow's "Hypertext and Literary Theory" course this spring made creative use of the Storyspace view to express the connections among the spaces in the webs. They did this by making most links between spaces at a single level. When working within this constraint the results can be visual suggestive of the shape of relationships the author has in mind.

When working on an online documentation system, we proposed a variation of the Intermedia Web View shown in Figure 4a and 4b. The currently selected node is shown with a dotted outline. This system adds the notion of a container or parent element which appears above the currently selected node.

Linked nodes are divided into two groups, with "child" documents immediately below the selected node. "See also" or lateral links are grouped separately at the bottom of this list. This system is well suited for representing a network of links within a document hierarchy, a common situation in software and hardware documentation.

Figure 3a
Link browser for online documentation system

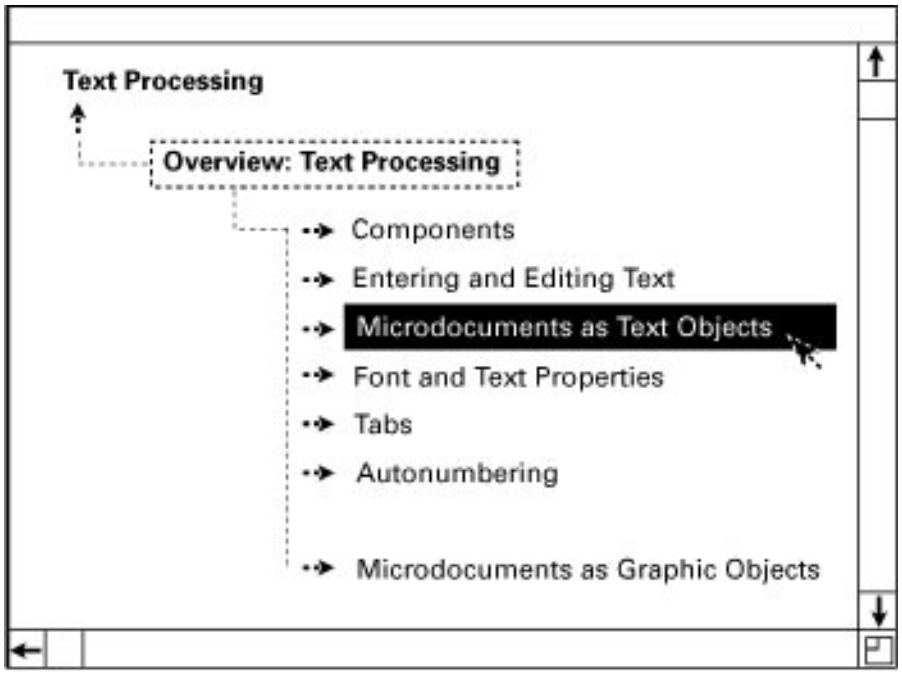
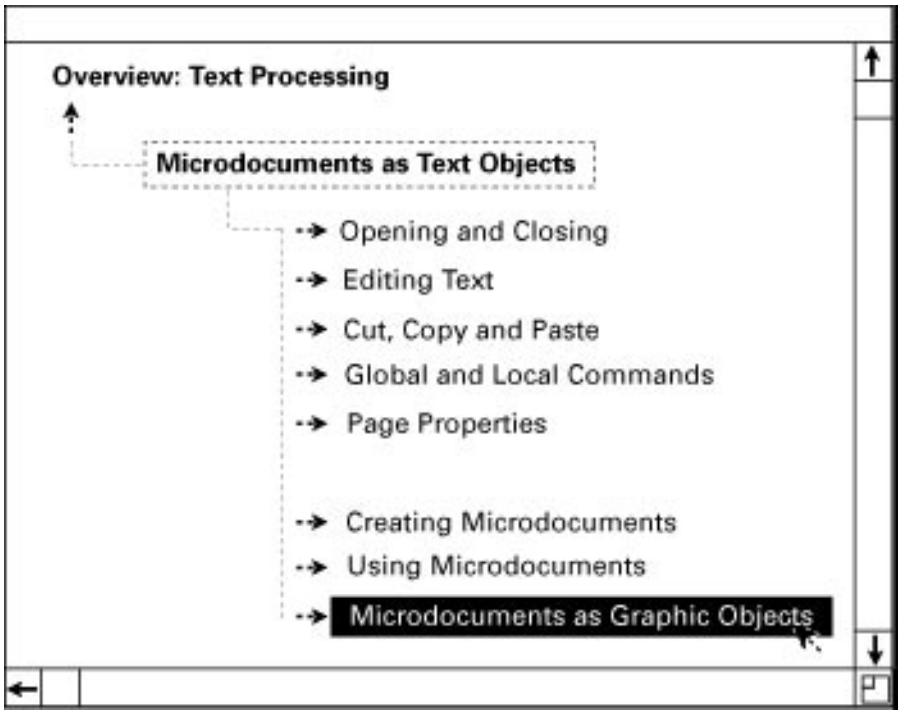


Figure 3b
Following a link to the node highlighted in Figure 3a above will redraw the view as shown here



Conclusion

We have demonstrated how the three basic elements of visual rhetoric needed to support a hypertext system have been implemented in Intermedia and Storyspace, two system used at Brown University. We have also shown several examples of alternative designs developed by Dynamic Diagrams.

Neither system is entirely successful in supporting the visual needs of a hypertext system. We have pointed out areas where improvements in future systems will help support the user's navigational needs in a clearer and more comprehensive manner.

However, both systems are noteworthy in that they do provide some support for each of the three basic elements we describe. Other systems we have used at Brown, such as Interleaf's WorldView, Apple's HyperCard, and Electronic Book Technologies' *DynaText*, are entirely lacking in one or more of these three basic elements.

We are reminded of a meeting in 1985 at which the representative of a major computer company explained that his company recognized how the choice of a windowing system would be a very important one for his new product. Since his company could not agree on what the best windowing system should be they had decided to bring the new product to market without one, rather than risk making the wrong choice. We hope that the developers of commercial hypertext systems do not make the same mistake a decade later. There are no clear winners in the areas of link presence, link destination, and link mapping and the problems each system must solve are varied and complex. However, the hypertext developer who avoids confronting these challenges will quickly look like a workstation without a windowing system.

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