Technical Briefing

# Enactment in Information Farming

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## ABSTRACT

*Information farming* views the cultivation of information as a continuing, collaborative activity performed by groups of people working together to achieve changing individual and common goals. Failure to differentiate information farming from related but distinct activities like information mining and data factories has been a fruitful source of misunderstanding and discord in the hypertext literature and in the design of hypertext environments. Dramatic enactment and visual salience — not recall, precision, or usability— assume primary roles in design for information gardening. In this technical briefing, we examine how enactment contribute to the success and failure of a variety of Hypergate and Storyspace features.

## KEYWORDS

Design, rhetoric, enactment, collaboration, information farming

## INFORMATION FARMING

Three fundamentally different and incompatible metaphors (pace [Halasz 82]!) shape both the design of hypertext systems and the rhetorical styles in which these designs are proposed and defended.

**Information Mining** views pertinent information as a valuable resource to be efficiently extracted and refined. Successful mining tools are those which can most quickly extract valuable nuggets of precious fact from large repositories of base data, and the classic measures of successful mining are recall, precision, and cost [Salton 83].

**Information Manufacturing** views the acquisition, refinement, assembly and maintenance of information as a continuous enterprise. employing teams of specialists to implement acquisition procedures and management strategies. In contrast to mining, with its individualistic emphasis on seizing information and opportunity, the rhetoric of the information factory values continuity of process over individual entrepreneurship. Successful information factory tools are those which create large stocks of corporate information with inexpensive, interchangeable labor; the classic measures of successful factory systems is usability [Nielsen 90]: ease of initial learning, productivity, and accuracy of work product.

**Information farming** (or gardening) views the cultivation of information as a continuing, collaborative activity performed by groups of people working together to achieve changing individual and common goals. Where the mine and factory serve the organization, the information farm is a computational space where colleagues and employees may work together on shared tasks and also pursue individual goals. The focus is neither on extraction (as in the mine) nor on stockpiling (as in the information factory), but on continuous cultivation and community. The vision of information farming is integral to the romantic school of hypertext [Engelbart 63, Nelson 76], and the different goals of the information farm and information mine have been a fertile source of misunderstanding between the hypertext and information-retrieval communities.

The design goals of farm implements differ from those customarily applied to mining tools and factory systems. Because farming is a continuous activity, measures of discrete transactions (e.g recall rates) are less central to farming than to mining. Moreover, traditional human-computer interface studies concentrate on easily-measured, everyday phenomena—the repetitive activities of the factory rather than the disparate activities of the information farm. The success of farming systems lies at least as much in the extent to which they can convey insight or explain extraordinarily difficult concepts as in their facility for expressing routine matters [Bernstein 91]. Anecdotes and reading logs [Douglas 92] — records of personal experience over an extended course of thoughtful use and introspection — are a more characteristic approach to studying actual information farms and farmers than statistical surveys of sample subjects.

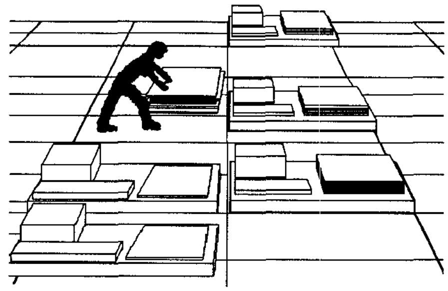

Figure 1. A user's avatar, seen at work sorting the messy piles and spatial aggregates found in the fields of an information farm. Redrawn from [Marshall 92] figure 2, a more conventional view of the same farm.

## ENACTMENT

In evaluating experience with Aquanet [Marshall 91]— the system whose visual representation originally suggested the farming or gardening metaphor— Marshall and Rogers identify attributes which are key to the success of an information farming environment [Marshall 92]:

**Perspicuity and representational salience**— the system's ability to support and to suggest important relationships, and to adjust the internal representation and external presentation of these relationships as the user gains new insights.

**Relational volatility**— support for rapidly-changing patterns of linkage.

**Informal relationships**— support for workspaces and related activity-based regions both as an aid in individual performance and as a basis for communicating ideas about the emerging structure of collaborative spaces.

These normative criteria depart notably from the performance-based criteria of information mining as well as from the ease-of-learning and ease-of-use concerns of the information factory.

Note that these attributes are static, describing snapshots of an evolving hypertext rather than the *process* of creating or using the work. A closer focus on the dynamics of interaction between collaborators and a constructive hypertext [Joyce 88] suggests a fourth criterion:

**Dramatic enactment**— the system's ability to clearly and effectually present salient changes as dynamic phenomena.

Our interaction with a complex and volatile hypertext, after all, is not merely a procession from snapshot to snapshot, from one screen configuration to another; to make sense of a collaborator's or a computational agent's actions in a complex environment, users need to be shown how the change was effected. The computer *enacts* the change to make the process of change evident, and this enactment [Laurel 91], examined in detail, recapitulates a familiar pattern of Aristotelian drama:

| | |
|---|---|
| exposition | establishing the context and focus of the action |
| rising action | enacting the performance of the action |
| climax | enacting the completion of the action |
| falling action | enacting the propagation of changes caused by the action |
| dénouement | establishing that the performance is complete, returning focus to the user and her next action |

Enactment need not be graphically elaborate; for example, SEPIA's doorbell chime gracefully enacts the entrance of a new participant into an argumentative space [Streitz 89] [Streitz 92].

## ENACTMENT IN THE STORYSPACE MAP

The Storyspace map view represents a hypertext as a collection of nested writing spaces connected by named, directed links [Joyce 91]. Users arrange writing spaces by dragging them with the mouse to create ad hoc spatial structures; Intermedia's Web View [Utting 90] [Landow 92], NoteCards [Halasz 87], and MacWeb [Nanard 91] are among the systems that feature a similar presentation. Storyspace maps represent hierarchies as nested writing spaces; to subordinate one writing space to another, the user drags it inside its parent (Figure 2).

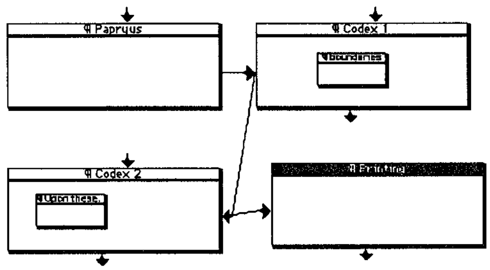


Figure 2. Storyspace view of a section of *Writing Space* [Bolter 91]. Subsections are visible inside other writing spaces.

Other interfaces are easily imagined ; one might, for example, issue the command `Put Codex 1 into Codex 2`, or choose SUBORDINATE SELECTED SPACE from a menu. Indeed, Storyspace itself provides several facilities like these. The most popular way to construct a hierarchical relationship, however, is to "drag one writing space into another"— a shorthand description of a carefully enacted process:

| | |
|---|---|
| exposition | the user points to a writing space, which is highlighted to focus attention upon it. Links to the space are hidden to further focus attention and clarify the action. |
| rising action | the user drags the chosen space towards its destination. |
| climax | as the writing space crosses the threshold of its destination, it instantly shrinks in size to show it is now inside another space. The change is reversible if the user carries the space outside the destination. |
| falling action | the user releases the writing space, which is now drawn in its new position. |
| dénouement | links and spaces formerly obscured by the moved space are redrawn. |

Notice that a considerable computational burden is required to support this enactment, compared to the trivial pointer manipulation required to support the action itself. The enactment takes extra time, yet experienced as well as novice users uniformly prefer the enactment to more direct approaches. By clearly representing the process of change, the enacted version preserves a sense of control and orientation.

This preference for enactment explains Akscyn's well-known discovery, in which very fast link traversal was found less usable than link traversals that required ~0.25 sec [Akscyn 87]. If link traversal is very fast ($t<<1/60$ sec), the display shifts instantly from one state to another. When the refresh rate is slowed to a perceptible speed, the user sees a rapid but noticeable enactment of the change. Even slower enactments— for example, elaborate page-turning animations [Atkinson 87]— are useful for special effects (cf. [McDaid 93]) but distract readers when used inappropriately by *overdramatizing* a routine action.

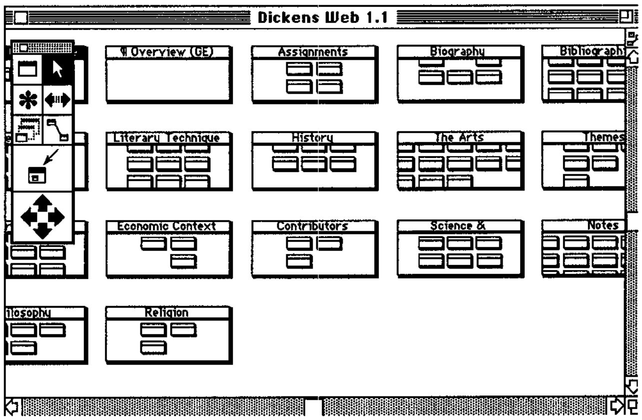


Figure 3. A Storyspace map of The Dickens Web [Landow 92a,b]. Window cleaning has been used throughout to arrange writing spaces in a regular grid.

Powerful commands that are not enacted are disliked—often heartily disliked—by users. Storyspace provides a powerful menu choice, CLEAN UP WINDOW, which gathers messy arrays of writing spaces and arranges them in a symmetrical grid. The window cleaner is fast, easy-to-use, and highly unpopular; more than one user, after accidentally cleaning up a carefully-arranged window, has requested that the command be expunged from the program.

## BREADCRUMBS

Breadcrumbs, an oft-cited but rarely reimplemented facility, mark links that will return the user to a recently visited place [Bernstein 88]. Because some writers (e.g. [Rouet 90]) interpret revisiting a recently visited node as a symptom of disorientation, and because disorientation has been considered a leading problem facing hypertext designers, one might have expected breadcrumbs to have become a staple feature in modern hypertext systems. Breadcrumbs are cheap and easy to implement; why are they uncommon?

In retrospect, it is clear that the enactment of breadcrumb placement in Hypergate is poor. Breadcrumbs, naturally, are dropped *behind* the reader to mark her trail; readers see breadcrumbs not when they are dropped, but only later when they are about to recross their trail. Like other static displays, breadcrumbs reflect state but not process; I know what a breadcrumb means, but often have no idea how it came to be there. The history pane of the Symbolics Document Examiner [Walker 1987][Walker 88] presented an ever-growing list of writing spaces the user had visited; the appearance of a new place on the list served as an enactment of breadcrumbs, but at the cost of reserving a significant fraction of the screen for a rather infrequently-used display. The Storyspace WORD COUNT and STATUS is Storyspace dialogs are almost invariably surprising, because they describe what has happened (e.g. I have run out of memory or exceeded my page count) after the fact. Small animated meters (Figure 4) that continuously display document size or memory allocation are less astonishing, not because their graphic nature makes them easier to understand (quite the opposite!), but because they provide immediate, incremental depiction of the consumption of resources.

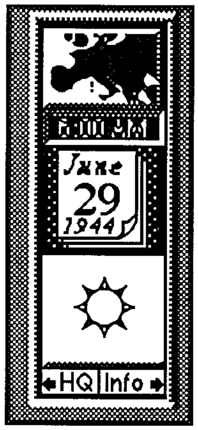


Figure 4. A compact set of meters from [Atomic 92]. The meters are not easier to read or use than conventional textual descriptions , but their small size permits continuous display. Gradual changes like the passage of time or change of weather are enacted incrementally.

## SCROLLING, LINKING, AND THE LENGTH OF LEXIA

Storyspace's writing spaces, like Intermedia's lexia [Landow 92], have no fixed size; if the contents of a writing space cannot fit into the window, Storyspace provides a scroll bar to allow readers to move within the space. When constructing an extended linear argument, writers must choose whether to extend their current space or to create a new writing space that is linked to it. Indeed, the choice of node size and the tradeoff between scrolling and link traversal is a common topic of discussion among Storyspace writers.

Considered afresh, however, linking and scrolling are nearly identical operations. Whether we scroll within a writing space or follow a link to a new space, we see a single underlying change: in electronic text, text *replaces* text while on paper text *follows* text [Bolter 91]. Why does initiating the replacement by pressing a down-pointing arrow instead of a text link or link icon carry such profound rhetorical weight?

In the end, the process of scrolling differs from the process of following a (linear) chain of links only insofar as scrolling is more vividly and specifically enacted. In Storyspace, link traversal is abrupt; the current writing space is replaced by a new writing space. In Intermedia, link traversal evoked the appearance of the new article in its own window—an alternative behavior Storyspace also offers. Both enactments are necessarily very simple and very broad; the same enactment describes link-following in any context. Scrolling, on the other hand, is enacted in a specific manner that emphasizes linear progression:

| | |
|---|---|
| exposition | the scroll tool is highlighted |
| rising action | information gradually moves up or down within the view |
| climax | the information the reader seeks appears in sight |
| falling action | the user releases the mouse |
| dénouement | the scroll tool reverts to quiescence |

Scrolling thus enacts a *linear* trajectory through a sequence of texts, a special case of the more general link-following enactment. Other ways of enacting link traversal can provide valuable structural cues, and other enactments of linear progression are indeed possible. For example, we might represent scrolling in a card metaphor system by the following cinematic sequence:

| | |
|---|---|
| exposition: | transform the current writing space to its iconic map representation |
| rising action: | pull back to view the current sequential structure of the map |
| climax: | pan to follow the "active selection" marker as it moves to the next writing space |
| falling action | transform the newly selected space into its textual representation |
| dénouement: | change the cursor to inform the user that the action is complete |

Similar enactments of annotation, path splitting, tree traversal, and other common structural idioms can be imagined. Note that enactments need to be visual; in *Victory Garden* [Moulthrop 91], for example, Moulthrop uses written correspondence as a framing device to demarcate episodes, and elsewhere energetically intercuts memories of previous passages to enact a post-apocalyptic coda.

## CONCLUSION

Dramatic enactment allows information farmers to perceive and thus to understand the process of change as it occurs. Enactment fares poorly when evaluated by the criteria of information mining or the software factory, yet plays a central role in determining the acceptability and utility of software designs for individual information gardens and collaborative information farms.

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