PATTERNS OF HYPERTEXT

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ABSTRACT
The apparent unruliness of contemporary hypertexts arises, in part, from our lack of a vocabulary to describe hypertext structures. From observation of a variety of actual hypertexts, we identify a variety of common structural patterns that may prove useful for description, analysis, and perhaps for design of complex hypertexts. These patterns include:

- Cycle
- Counterpoint
- Mirrorworld
- Tangle
- Sieve
- Montage
- Split/Join
- Missing Link
- Feint

KEYWORDS: design, patterns, pattern languages, rhetoric, hypertext structure, criticism, navigation

PATTERNS OF HYPERTEXT
The complexity and unruliness of the complex webs of links we create has frequently led to calls for "structured" or otherwise disciplined hypertext [33][20][75]. While calls for clearer structure have tried to avoid, consolidate, or minimize links, it is now clear that hypertext cannot easily turn its back on complex link structures. Where it was once feared that the cognitive burdens of large, irregular link networks would overwhelm readers, we find in practice that myriad casual readers flock to the docuserve. The growth of literary and scholarly hypertext, the evolution of the Web, and the economics of link exchange all assure the long-term importance of links.

Since large linked constructs cannot be wished away, it is time to develop a vocabulary of concepts and structures that will let us understand the way today’s hypertexts and Web sites work. Progress in the craft of writing depends, in part, on analysis and discussion of the best existing work. An appropriate vocabulary will allow us both to discern and to discuss patterns in hypertexts that may otherwise seem an impenetrable tangle or arbitrary morass. The reader’s experience of many complex hypertexts is not one of chaotic disorder, even though we cannot yet describe that structure concisely; the problem is not that the hypertexts lack structure but rather that we lack words to describe it.

LOOKING FOR PATTERNS
This paper describes a variety of patterns of linkage observed in actual hypertexts. Hypertext structure does not reside exclusively in the topology of links nor in the language of individual nodes, and so we must work toward a pattern language through both topological and rhetorical observation. Instances of these patterns typically range in scope from a handful of nodes and links to a few hundred. These patterns [29][3] are components observed within hypertexts, rather than system facilities (see [67]) or plans of a complete work. Typical hypertexts contain instances of many different patterns, and often a single node or link may participate in several intersecting structures.

I do not argue that the observed structural patterns are uniquely desirable, that superior patterns cannot be devised, or indeed that the writers of these hypertexts meant to use these patterns at all. I do propose that by considering these patterns, or patterns like them, writers and editors may be led to more thoughtful, systematic, and sophisticated designs. These patterns are offered, then, as a step toward developing a richer vocabulary of hypertext structure.

Examples are drawn from published stand-alone hypertexts as well as from the Web. Web sites are readily accessible but volatile: a site which today illustrates one structure may be unrecognizable tomorrow. Published hypertexts are less accessible, but are also more permanent. Moreover, some important patterns depend on dynamic links — links which depend on the reader's past interactions. The Web itself is state-free, and while various implementations of state-dependent behaviors for the Web have been proposed,
state-dependent behavior remains an exceptional case in Web hypertexts.

Some pattern examples are drawn from literary fiction. I do not believe these patterns to be useful exclusively for fiction; rather, a variety of economic and cultural factors sometimes encourage experimentation in narrative rather than technical writing or journalism. Moreover, hypertext fiction tends to be written for general audiences and may remain available indefinitely, while specialized reference manuals and Help systems may be short-lived and less readily available to the general reader. Nor does our interest in structural vocabulary necessarily imply a structuralist or post-structuralist stance; we need to describe phenomena, whatever our theoretical beliefs [48][1].

Two patterns — Tree and Sequence — have been described many times in the hypertext literature [16][64]. Both are useful, indeed indispensable, and can be found in almost any hypertext.

**CYCLE**

In the Cycle, the reader returns to a previously-visited node and eventually departs along a new path. Cycles create recurrence [12] and so express the presence of structure. Kolb's *Socrates In The Labyrinth* [45] discusses the role of the Cycle in argumentation, showing how hypertext cycles emerge naturally from traditional argumentative forms. Cyclical repetition also modulates the experience of the hypertext [44], emphasizing key points while relegating others to the background. Writers may break a cycle automatically by using conditional links, or may use breadcrumbs [7] to guide the user to depart along a new trajectory. Relying on breadcrumbs to break cycles is common on the Web.

In *Joyce's Cycle*, the reader rejoins a previously-visited part of the hypertext and continues along a previously-traversed trajectory through one or more spaces before the cycle is broken. Revisiting a previously-visited scene, moreover, may itself provide a fresh experience because the new context can change the meaning of a passage even though the words remain the same. The opening lines of *afternoon, a story* [38], when first seen, establish a chilly climate, poetic and overwrought:

*By five the sun sets and the afternoon melt freezes again across the blacktop into crystal octopi and palms of ice-- rivers and continents beset by fear, and we walk out to the car, the snow moaning beneath our boots...*

Later, we may again encounter the same scene. No longer does it serve as an establishing frame; later, we may recognize that the winter scene the narrator describes might be the wreck of his ex-wife’s car, that the continents of fear, the moaning snow, may be the wreck left after the car (and the bodies) have been removed. Hypertext, Joyce writes elsewhere, demands rereading [39]. Measured and planned repetition can reinforce the writer's message: end-of-chapter summaries and ballad refrains, for example, are a common feature of the pedagogical literature of print and oral culture. Cycles thus lend themselves not only to a variety of postmodern effects [61], but also to familiar writerly motifs.

*Of recursus, there is hallucination, déja vu, compulsion, riff, ripple, canon, isobar, daydream, and theme and variation...* Of timeshift there is the death of Mrs. Ramsay and the near disintegration of the house... *Leopold Bloom on a walk, and a man who wants to say he may have seen his son die. Of the renewal there is every story not listed previously.* [39]

In Douglas's *Cycle* [23], the appearance of an unbroken cycle signals closure, the end of a section or the exhaustion of the hypertext.

A **Web Ring** is a grand cycle, a cycle that links entire hypertexts in a tour of a subject. Hypertexts in a Web ring agree, in essence, to share readers. Though largely unheralded in the research literature, Web rings, C.R.E.W. and related compacts have proved central to the hypertext economy. Hypertexts concerning specialized interests — obscure actors, or World War I memoirs — may promise little direct professional or commercial importance, and alone they cannot easily find an audience. Cooperation among related sites, however, creates self-organizing zones of autonomous but interrelated activities on a common theme or toward a common goal. The cyclical structure of Web rings tends to promote equality of access: each participant gains one inbound link, at the cost of offering one outbound link. Alternative structures (such as central directories and search engines) can also offer access, but the cyclical structure of the ring keeps each participant equal and resists the tendency to concentrate attention at the directories themselves.

A **contour** [12][40] is formed where cycles impinge on each other, allowing free movement within and between the paths defined by each cycle. Movement among the cycles of a contour is easy, and infrequent links allow more restricted movement from one contour to another.

**COUNTERPOINT**

In Counterpoint, two voices alternate, interleaving themes or welding together theme and response. Counterpoint often gives a clear sense of structure, a resonance of call and response reminiscent at once of liturgy and of casual dialogue. Counterpoint frequently arises naturally from character-centric narratives; for example, *Forward Anywhere* [54] uses a
series of e-mail letters between its two central characters to explore their differences and establish their connections.

Counterpoint may be fine-grained. In *Bubbe’s Back Porch*, Abe Don’s Bubbe moves constantly between tales of the distant past and tales of her own present, telling her great-granddaughter at once what it is like to be old and what it was like, long ago, to be a young Jew in old Russia [21]. Don moves between times and voices within a single lexia, echoing the patterns of traditional Yiddish storytelling (see, for example, the work of Sholem Aleichem [2]). It is also interesting to observe how the same counterpoint techniques can be adapted to decenter the subject[28], for here (as in Spiegelman’s *Maus* [71]) traditional narrative techniques yield postmodern effects.

At a large scale, Don’s hypertext is essentially linear, and the internal counterpoint (and the Missing Link patterns suggested by recurrent antique photographs) forms the chief hypertextual element. Adrienne Greenheart’s *Six Sex Scenes* [34], on the other hand, offers three or four outbound links from almost every node. Greenheart’s hypertext habitually alternates time frames; a writing space describing a childhood scene tends to be linked to scenes of adult life, and adult scenes tend to be linked to stories of childhood. Because Greenheart, in *Six Sex Scenes*, works hard to avoid Cycles, the Counterpoint of childhood and adult experience is its most prominent structural element.

In “Interlocked” [22], Deena Larsen addresses a topic closely allied to Greenheart’s: how memories of childhood or adolescence find expression in the sexuality of the adult protagonist. Where Greenheart uses Counterpoint as a substitute for the structural power of Cycle patterns, Larsen builds her hypertext from two interlocked Cycles. These cycles, inspired by a classic quilt pattern, represent self-reinforcing traumas of past and present. Concurrently, links between cycles create a “quilted” counterpoint that represents the interplay of memory and action; the counterpoint, like quilt stitching, distorts the cycles while holding them in place.

Interstitial counterpoint adds hypertext commentary notionally situated between writing spaces. Interstices have long been used for quotation, both epigraphic and ironic [13]. Links in Larsen’s *Samplers* appear in a dialog box — a conventional list of links that Storyspace authors can use to build an ad hoc multi-tailed link. The dialog is designed to be purely functional, showing a list of links by pathname and destination, but Larsen has chosen path names so that this list itself can be read as an interstitial poem. Edward Falco independently discovered the same, unexpected Counterpoint opportunity in his hypertext poetry, “Sea Islands”, where the interstitial writing includes both path names and destination titles [26].

Counterpoint writ large, the dialogue amongst hypertexts proposed in “Conversations With Friends” [8] is constructed as Counterpoint among several independent hypertexts, each representing a recognizable point of view and each capable of responding to links and trajectories within its own frame and those of other active hypertexts.

**MIRRORWORLD**

To retain coherence, writers of both texts and hypertexts frequently adhere to a single voice and point of view. Mirrorworlds provide a parallel or intertextual narrative that adopts a different voice or contrasting perspective. The Mirrorworld echoes a central theme or exposition, either amplifying it or elaborating in ways impractical within the main thread. Where Counterpoint interweaves different voices of equal (or nearly equal) weight within a single exposition, the Mirrorworld establishes a second voice that separately parallels (or parodies) the main statement. (The term “Mirrorworld” is meant to allude to Through The Looking Glass and to funhouse mirrors, not to Gelernter’s monograph [32].)

In *Uncle Buddy’s Phantom Funhouse* [56], by John McDaid, readers explore the computer files of the late Arthur Newkirk through his HyperCard home page, which is organized in the image of his house. The back door, obscurely labeled “Egypt”, allows passage to Newkirk’s locked files; these files, once the reader gains access, appear in a distorted image of the house, retitled “Auntie Em’s Haunt House”. In this haunted funhouse, the content and concerns of Newkirk’s HyperCard house are mirrored in darker extensions and parodies. McDaid adds depth to the reader’s knowledge of Newkirk through this distorted addition to his life and work.

The central thread of Edward Falco’s *A Dream with Demons* is a novel-within-the-novel: a story of a woman, her daughter, and her lover, wrapped together in love and violence [25]. This narrative is interrupted periodically by navigational opportunities that lead the reader into a basement of notes and memories, purportedly belonging to the notional author. Falco thus superimposes two layers of fiction: the dramatic conflict of incest and abuse in the conventional narrative is echoed by the more complex and ambiguous backstory of the Mirrorworld. The Mirrorworld also here plays an intriguing formal role: by revealing the thoughts and motives of the story’s notional creator in a

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**Figure 1.** In *Samplers*, a list of links connecting two writing spaces becomes an interstitial voice in counterpoint to the main text.
second fiction, the basement invites the reader to speculate on the nature of authorship more deeply than the familiar reader/writer dichotomy[41][28].

Kathryn Cramer's “In Small & Large Pieces” [18] defies coherence in its central thread, which is told backward and which veers unpredictably between a mundane squabble between children and a horrific fantasy of the grand unified parent. Its Mirrorworld interleaves brief and impressionistic sketches of interior life — perhaps of the protagonist at a later time, perhaps of the author as a younger woman. Here, the Mirrorworld is spare and fragmented, resisting even the retrograde coherence of the central thread; without determined effort, the reader finds it difficult to remain in the Mirrorworld. The fragmentation reflects the shattered mirror of the work's title, the mirror world cannot be put together again, but sharp, silvery splinters are always underfoot.

TANGLE

The Tangle confronts the reader with a variety of links without providing sufficient clues to guide the reader's choice. Tangles can be used purely for their value as intellectual amusement, but also appear in more serious roles. In particular, tangles can help intentionally disorient readers in order to make them more receptive to a new argument or an unexpected conclusion [50][9].

On entering a hypertext, a tangle can lead visitors to different entry points, helping to convey the breadth of a hypertext to readers who may not anticipate the hypertext's scope or coverage. The home page of designer David Siegel [69], for example, opens with four identical icons that lead to four different "home pages" — each offering a different design and a different emphasis. New or infrequent visitors must choose arbitrarily, and thus will likely see different parts of the site on each visit [68].

Readers may, through habit or preconception, form an excessively narrow view of a hypertext. Because tangles are difficult to fit into a simple, preconceived structure, they encourage browsing and discovery. Tangles may extend through many writing spaces [19] or, like Siegel's entryway, may be limited to a single Montage. Tangles are frequently encountered near the beginning of a hypertext, where they disrupt orientation and create a sense of depth, but Carolyn Guyer's Quibbling [35] places a maze at the center of the hypertext, forming a bridge between scenes or episodes. Tangles may be used as pacing devices, or to recapitulate moments or pathways encountered earlier in a reading. Tangles are often found within or adjacent to Mirrorworlds.

Moulthrop terms hypertexts robotic when the logic of the hypertext, not reader choice, tends to dictate the course of a reading [58]. Robotic tangles like Mary-Kim Arnold's “Lust” [4] combine complex dynamic structure, rich in broken cycles and other structural cues, with a dearth of interactive choice. This structure serves to entice the reader while frustrating the quest for release and resolution.

SIEVE

Sieves sort readers through one or more layers of choice in order to direct them to sections or episodes. Sieves are often trees, but may be multitrees, DAGs, or nearly-hierarchical graphs; different topologies may all serve the same rhetorical function.

Where the choice is informed and instrumental, sieves become decision trees. The Yahoo directory, for example, provides a large sieve that readers traverse to find topical entry points to the Web. Sieves need not be represented as explicit hierarchies; the Hot Sauce MCF browser displays sieves in three-dimensional space and permits readers to "fly" in SemNet style[24] through the sieve to their destinations, whereas the Hypertext Hotel [17] hides its introductory Sieve behind a check-in desk and hotel lobby.

MONTAGE

In Montage, several distinct writing spaces appear simultaneously, reinforcing each other while retaining their separate identities. Montage is most frequently effected through superimposed windows which establish connections across the boundaries of explicit nodes and links.

Montage is prominent in the pedagogical hypertexts of George P. Landow [47, 51], each of which commences with a montage offering multiple points of departure [49]. Shelley Jackson’s Patchwork Girl [37] also uses windowed montage with intriguing effect. Christiane Paul’s Unreal City [65] breaks the frame of the screen, using montage between the screen and a conventional paper book, held in the viewer's hand. An iconic representation of the printed page mediates the montage, thus freeing screen real-estate.

Figure 2. A montage from Patchwork Girl [37] as it appears in Writing At The Edge [50]
Montage is a fact of life in the design of museums and art galleries, where disparate visual works are collected in a limited space. Thoughtful architecture and clever arrangement may minimize the disruptive effects of montage, while juxtaposition may suggest new insights. Some art-historical hypertexts attempt to recreate the architectural montage of real or virtual museum spaces; often, as in the masterful Musée d'Orsay: Visite Virtuelle, the subject of such a hypertext becomes the museum itself rather than its collections [15].

Trellis [72] is extensively — perhaps primarily — concerned with describing and managing montage.

NEIGHBORHOOD
A Neighborhood establishes an association among nodes through proximity, shared ornament, or common navigational landmarks. Unvarying thumbnails, a navigation bar, or a miniature site map can all inform readers that the lexia in which they appear are "close" in some planned way. Just as a prominent church spire shows a walker that two spots separated by long, winding streets are still in the same neighborhood [53], deliberate display of commonality in a hypertext can express individual links might not emphasize [7]. (Rosenberg's episodes [66] are closely related to our Neighborhoods; "neighborhoods" emphasizes the presence of patterns of meaning in the hypertext while "episode" places greater emphasis on the experience these structures create in the reader's perception. See also Rossi's Navigational Contexts pattern[67]).

For example, Nielsen has described the inherent conflict in large Web sites between establishing the identity of a particular hypertext and the identity of the site itself [63]. If each page of a Web site is separately designed and optimized for its own purposes, the site as a whole may lose its coherent identity and its brand name may be obscured. As a solution, Nielsen proposes adopting a uniform navigational frame or subsite as a Neighborhood pattern that organizes the collective site, adding layers of incremental navigational ornament to subsites as needed to create subsidiary identities.

Visual motifs often reinforce the identity of Neighborhoods in order to establish organizational context or to call attention to relationships among concepts. When Musée d'Orsay: Visite Virtuelle [15] adopts the structure of the museum to shape the hypertext, it effectively echoes subtle issues of history, historiography, and politics that have shaped both the composition and presentation of the national art collection. Millet leads to Courbet and on to Manet; Courbet's contemporary Couture, standing outside this tradition, hangs across the allée centrale rather than in the adjacent room. The use of inherited ornament and navigational apparatus to identify and situate a piece of a hypertext as a component of a larger structure traces back to HyperCard backgrounds [5] and HDM [31].

In VIKI [55] and Web Squirrel [10], spatial proximity is used less to establish Montage than to define spatial Neighborhoods that represent informal relationships among elements.

SPLIT/JOIN
The Split/Join pattern knits two or more sequences together. Split/Join is indispensable to interactive narratives in which the reader's intervention changes the course of events. If each decision changes everything that happens subsequently, authors cannot allow the reader to make many decisions while keeping the work within manageable bounds[14]. Splits permit the narrative to depend on the reader's choice for a limited span, later returning the reader (at least temporarily) to a central core. (By recording state information, the author may design subsequently-encountered sequences to split in consequence of an early choice; these splits, too, will usually be reconciled by a join.)

The Rashomon pattern [46] embeds a split-join within a cycle. The split/join effectively breaks the cycle, as readers explore different splits during each recurrent exploration, yet the cycle remains a prominent frame that provides context for each strand. Sarah Smith's King of Space [70] uses a three-way split at the end of its entrance sequence to explore the case by case choices may involve the reader in acts she would never sanction. The split appears trivial and game-like when first encountered, but becomes morally meaningful only after the reader has explored alternative paths.

Overviews and tours [76][77] are examples of Split/Join where the rhetorical intent of each path is similar, but one side of the split is more detailed than the other. Writers typically offer overviews and tours as a service, but Split/Join need not be purely utilitarian. In Moulthrop's Move, for example, the hypertext offers a Split; the hypertext responds ironically to the reader's apparent motivation instead of responding directly to the link's overt message[59], in a style later popularized by the Web magazine Suck. Hypertext may resist; it need not merely serve the reader's whims.

MISSING LINK
At times, a hypertext may suggest the presence of a link that does not, in fact, exist. For example, Stuart Moulthrop, reviewing Forward Anywhere [54], describes his hunt for a link that his reading of the hypertext led him to expect:

At this point I began to think the two "nightmare" passages must be connected by a hypertext link, so I launched the reading program and made my way to Malloy's screen about the freight trains of yesteryear..., there were many links to other screens, mainly screens written by Marshall, this alternation of narrators is prevalent throughout the work). None of the links I followed, however, brought me to Marshall's vignette about LBJ and the headless doll....
Allusion, iteration, and ellipsis can all suggest a Missing Link. Structural irregularity, introduced in a context where regular structure has been established, presents an especially powerful Missing Link, for a place to which we cannot navigate may seem, by its inaccessibility, uniquely attractive. Harpold and Joyce have argued separately that the Missing Link is a common if not universal hypertext motif, that navigational choice requires the reader to imagine not only what might appear on the chosen page but also what might have appeared had she followed a different link [36][39].

**NAVIGATIONAL FEINT**

The Feint establishes the existence of a navigational opportunity that is not meant to be followed immediately; instead, the Feint informs the reader of possibilities that may be pursued in the future. By revealing navigational opportunities even where they may not be immediately pursued, a hypertext writer conveys valuable information about the scope of the hypertext or about the organization of the ideas that underlie it.

Feints often appear in the guise of navigational apparatus. For example, a hypertext may begin with a map or table of contents that provides an overview of the entire work and provides direct access to selected places within the hypertext. While the navigational function is not unimportant, the rhetorical importance of the overview itself should not be overlooked.

Prominent and detailed navigational Feints are especially useful for establishing the scope and shape of a hypertext. Just as important, Feints may help establish what the hypertext omits. Notice that the feint need not always be strictly accurate; it is sometimes useful to deliver more than what was initially promised. For example, the classic **HyperCard 1.0 Help** [5] presented a thumtab overview that suggested to new readers that instructions on programming were only a minor part of the hypertext; readers who might be deterred from using a complex product were reassured that programming appeared to be a minor feature. In fact, over half of the hypertext was devoted to a programming reference manual. The navigational feint on the cover concealed this from programming-averse users, while those who wanted to consult the programming section were pleasantly surprised by its unheralded scope.

Moulthrop’s **Victory Garden** opens (in some readings) with garden maps that schematize the narrative [59]. The core narrative in Kathryn Cramer’s **“In Small and Large Pieces”** [18] is epitomized in episode outlines, cryptic epigrammatic lists that begin each narrative section and that lend the central narrative an apparent order and regularity that contrasts sharply with the disorder of the story’s Mirrorworld.

In addition to their utility as introductory and framing devices, Feints may form a recurrent motif throughout the hypertext’s structure. Spatial narratives like **Myst** [57] offer navigational feints in the form of doorways, structures, and other pathways that intersect the reader’s route; here, Feints signal possible openings for new narratives, roads the reader-protagonist may later choose to travel.

In narrative, navigational feints can establish spatial and temporal relationships without interrupting the narrative strand. By establishing a conventional link type — for example, an icon denoting “link to a simultaneous event occurring elsewhere”— a narrator can clarify and interconnect disparate events without interrupting the topic under discussion. Artful use of feints may also manage dramatic tension through foreshadowing: if we provide a
link from Alice and Herschel’s auspicious first meeting in a Tulsa oncology clinic to the birth of their daughter in Stockholm, the knowledge gained from the existence of the link sets up undercurrents of expectation and inquiry off which the rest of the narrative may play. By disclosing some parts of the future we may refocus the reader's attention and shift tension from one dramatic thread to another, or may shift energy from wondering how events unfold to permit better concentration on why they unfold as they do [43][30][6].

The Feint is also important in the design of hypertextual catalogs. As department stores discovered long ago, it is important both to offer the shopper a comprehensive array of desirable goods and to arrange those goods to form a coherent and compelling trajectory as the customer moves through the store. At its best, this provides efficiencies for both the shopper and the store: shoppers discover items they want to buy but might otherwise have overlooked, and the store gains additional transactions without incurring additional marketing costs. Catalogs similarly benefit from appropriate interconnection and by providing useful Feints en route to the object of desire [68]. By indicating the presence of other relevant items, the hypertext catalog can increase its efficiency without inconveniencing or delaying the reader.

CONCLUSION: COMBINING PATTERNS
All the patterns discussed here may (and usually do) contain other patterns as components. A Cycle, for example, may contain sequences and cycles as well as individual nodes. Two parallel cycles might be composed to form a Counterpoint pattern, or a group of cycles might converge to a Tangle. The great utility of structural patterns, in fact, derives in large measure from the ways that patterns can be combined to form larger structures. Where a familiar pattern appears prominently, its components are perceived as a coherent unit, what other writers have called an episode [66] or a region [44].

By developing a richer vocabulary of hypertext structure, and basing that vocabulary on structures observed in actual hypertexts, we can move toward a richer and more effective hypertext criticism, one that can move beyond the presentation-centered rhetoric so prevalent in current discussions of the Web. Simple names help us formulate concise queries and conjectures. A shared vocabulary of structures can facilitate both critical and editorial discussion, not only by facilitating the study of structure but also by helping us refer succinctly to the composites and aggregates that make up a hypertext.

Finally, we may note that our current tools for visualizing hypertext are not particularly effective in representing the patterns described here. Many Web-mapping programs, for example, uncover spanning trees on the hypertext graph and so tend to hide Cycle patterns. Conventional node-link views like Storyspace [42] and MacWeb [62] represent isolated cycles fairly well but provide little support for visualizing contours created where many cycles intersect. The elision implicit in NoteCards tabletops [74] or the nested boxes of Storyspace [11] helps to keep displays simple but hides patterns that span multiple containers. Some patterns (Mirrorworld, Missing Link, Feint, Montage) are not easily represented by conventional tools and require new visualizations to help writers (and readers) perceive, manipulate, and understand the patterns of their hypertexts.

ACKNOWLEDGMENTS
My understanding of hypertext structure is deeply indebted to discussions with Eastgate editors Eric A. Cohen, Kathryn Cramer, and Diane Greco, and with many Eastgate authors. Eric A. Cohen, David B. Levine, and David G. Durand read drafts of this work, and I am grateful for their many suggestions and improvements.

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