On Hypertext Narrative

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ABSTRACT

Annals and chronicles may be the foundation of accounting, but writers of stories and histories have long known that they seldom render a satisfactory account of complex events. In place of a simple chronological list, narrative instead organizes our account in new sequences in order to illuminate the interplay of actors and events. We want hypertext narrative to do things we cannot achieve in print; though we may occasionally use links to introduce variation in *presentation* or in *story;* it is now clear that hypertext will most frequently prove useful in changing (or adapting) *plot*. After discussing the ways in which plot may be varied, I describe the use of stretchtext as a reaction against the perceived incoherence of classic hypertext narrative, demonstrate the limitations that conventional stretchtext necessarily imposes on hypertext narrative, and describe an implemented generalization of stretchtext that matches the expressive and formal capabilities of classical hypertext systems while appearing to be a mere stretchtext and while running within the confines of a Web browser.

Categories and Subject Descriptors

H5.4 [**Hypertext/Hypermedia**]: Theory. I7.2 [**Document Preparation**]: hypertext/hypermedia. J5 [**Computer Applications**]: Arts and Humanities. *Literature.*

General Terms

Documentation, Design, Human Factors,

Keywords

Hypertext narrative, fiction, stretchtext, patterns

1. ANNALS AND CHRONICLES

Narrative describes events that unfold in time: stories, memories, histories, and procedural descriptions. Some narratives may be imaginary, others historical, and still others might describe future events.

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Hypertext narrative matters not only to artists and entertainers, but also to a wide range of hypertext writers. From historians to technical writers, from documenting the incidents that gave rise to a court case to specifying a treatment protocol for medical clinics, narrative is vitally important. Because hypertext is, by definition, non-sequential while narrative is fundamentally about sequence, hypertext has always challenged our understanding of narrative. If the reader may experience a hypertext in different sequences, what happens to the reader's understanding of the sequence of events?

When we first consider crafting a record of complex events, we might in the first instance contemplate a chronological record of occurrences – a diary or chronicle that lists events sequentially. This representation is ancient; we find it in Babylonian clay tablets, in the Roman *Fasti*, in biblical chronicles, in weblogs. In the form of the journal and ledger, it remains at the center of accounting.

Even the earliest historians recognized that chronicles or annals provide an inadequate account of history. For while a simple chronological list might clarify questions of temporal priority, it often obscures questions of causation. Unrelated events occur at the same time, while daily experience reminds us that causes precede consequences. Extraordinary events, such as a natural disaster or invasion, may easily overlap other events that, while ordinary in themselves, give rise to significant consequences. Events of immediate significance, a royal marriage or a solar eclipse, may coincide with events whose significance will not emerge for many years, such as the introduction of a new crop plant or the birth of a child who will, many years later, lead a successful revolution.

Even our oldest histories and stories depart from strictly chronological organization.

2. NOTES ON HYPERTEXT NARRATIVE

We want hypertext narrative to do things we could not achieve in print.

The study of narrative is, unfortunately, a terminological quagmire, and is further complicated by inconsistent usages and linguistic borrowings [27]. Broadly following Lowe, the *story* is the sequence of events that the narrative describes. These events are recounted to us in a (hyper) *text*. The text may be written, but it need not be: it might be cinematic, or a audible, or might combine writing and image in a variety of ways. The narrative text may not — indeed usually does not — describe events in the same sequence in which they occurred, but may depart from that sequence for clarity, emotional effect, or simply because two events took place at the some time.

A hypertext provides choices or *links* which the reader may use to move through the text, Links need not be represented as blue underlined text. In some hypertexts, we click on images, or on any word, or we type words or commands that change the hypertext's state. By choosing some links and not others, the reader may experience the text in different sequences. A specific trajectory through a hypertext is a *reading*. The sequence in which events are presented in a specific reading is a *plot*. [1]

What we see on the page or the screen is the *presentation*. Changes to the presentation of a hypertext need not change either the story or the plot. For example, we may wish to change our choice of typeface and size to accommodate different screen sizes and resolution; the experience of reading the text may be affected by this change, but we still recognize that we are reading the same hypertext[2]. Other changes to presentation may have some slight or superficial impact on plot or story, as when we add glosses to define unfamiliar words in an Elizabethan play, or when we add illustration or illumination to a book. Straightforward adaptive hypertext, where we convert miles to kilometers because we know the reader is in Belgium, or where we provide more detailed footnotes because we know the reader is a philologist, concerns itself primarily with presentation [40]. Indeed, simple elision of passages we believe will be redundant for a particular reader – including detailed explanations for students but omitting them for instructors – though nominally changing the plot, may often be regarded as a matter of presentation[3].

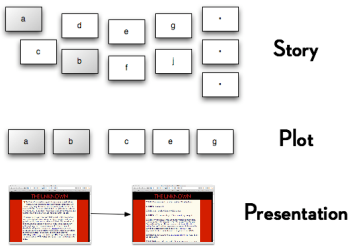

Figure 1. The relationship between *story, plot,* and *presentation.*

[1] Lowe demonstrates that we should have been better served had 20th century literary theory coined neologisms for these terms. As things stand, we are left with inconsistent and irreconcilable usages that vary by language and author, often based on mistranslated or incompletely-understood borrowings from other languages. What I have called *story* and *plot* are often *fabula* and *sujet* in English and in French, which borrow both from Russian. The computer-science reader is urged to treat these italicized terms as ground literals, without reference to their everyday meanings.

[2] Contrast the situation in painting: Henry Ossawa Tanner's *The Annunciation* (1898) is not Fra Angelico's (1438-1445), even though they depict the same figures and the same action. The Kelmscott Chaucer, on the other hand, is still *Canterbury Tales.*

[3] Mozart's Symphony No. 40 in G minor is still the same work in a performance that omits the repeats. Bruckner's Symphony No. 2 in C minor remains the same work though it exists in four versions – 1873, 1876, 1877, and 1892 – and though one version swaps the sequence of the second and third movements. Dante Gabriel Rosetti's propensity for textual variants gave rise to Jerome McGann's pioneering hypertextual study, *The Rosetti Archive* (http://rosettiarchive.org)

3. HYPERTEXT & CONSEQUENCES

We want hypertext narrative to do things we could not do in print; not only must a hypertext offer links, but the selection of links must be significant and consequential.

As a gedanken experiment, let us imagine a narrative that is presented to us as a hypertext. It offers links, which we may follow to new material. But though we are offered many links and invited to reflect and to choose one, in this text every link performs precisely the same action. We are invited to choose, but the behavior of the text does not depend on our choice.

How can we recognize this fraudulent hypertext? *We cannot know the links are inconsequential without rereading.* We must either use a "back" button to return to a previously-visited place, or we must follow a link that leads us in a cycle, or we must start over and read from the beginning, making new choices. Only by rereading can we distinguish a hypertext from this impostor.

Proposition 1: Hypertextuality is perceived through rereading and reflection.

Nor is it sufficient simply to assure ourselves that we have read everything, as we might through exhaustive search. Understanding the hypertext requires understanding the links it offers, both the consequences of following and the consequences of turning away [16]. We must not only consider each lexia, but where each lexia appears.

Early discussion of hypertext focused on the Navigation Problem [2], on reining in disorderly links and on the fear that hypertext readers would get lost. Early discussion of the Web proceeded along a similar course, focusing on reining in The Creatives, subordinating designers to "Information Architects" driven by the fear that Web pages would never be found. These twin concerns of navigability and findability shaped the dominant, conservative visions of hypertext and the early Web, most visibly by establishing hierarchy as the natural expression of Order.

The expression of hierarchy in hypertext gave rise to an emphasis on annotative structure, on departure and arrival. In the Web, the same impulse was expressed in an emphasis on signage and labeling, in the form of tabs and navigation bars.

4. CHANGING THE STORY

If our choice of links is to prove more than superficially consequential, links must either affect the *story* or the *plot*. Early thinking about hypertext narrative often contemplated the use of links to alter the story. We choose our own adventure, we become Prince Hamlet and experience the Holodeck [38].

Malleability of story presents a number of difficulties. The historian, for example, objects that the story her narrative describes cannot vary along arbitrary dimensions: though the historian makes myriad choices in selecting how to describe, say, the Battle Of Gettysburg, and though some aspects of the story may be obscured by incomplete evidence or contradictory testimony, we nevertheless believe that specific events took place[4]. The technical writer, similarly, may set out to describe the

[4] Either Shakespeare wrote *Hamlet*, or someone else wrote *Hamlet*. Lee Harvey Oswald acted alone, or he did not. The historian necessarily believes in fixity of story, though we might not know the story. A fiction writer may choose to be bound by the same rules, but is free to adopt others.

correct procedure for preparing dark veal stock or synthesizing basketene. In this context variation of the story is undesirable: we may explain the procedure in different ways, but the procedure itself is notionally constant. Even fiction writers may perceive story as invariant, as Shaw argues in his *Sequel* to *Pygmalion:*

> *The rest of the story need not be shown in action, and indeed, would hardly need telling if our imaginations were not so enfeebled by their lazy dependence on the ready-mades and reach-me-downs of the ragshop in which Romance keeps its stock of "happy endings" to misfit all stories.*

Modern and Postmodern writers have felt a certain affinity for malleability of story. A number of writers, in hypertext and in print, explore works where the story is not coherent, where an unreliable narrator, an unclear division between reality and imagination, or simply a breakdown of reality and perception leaves us with an inconsistent story. Coover's "The Babysitter", Cortazar's "Hopscotch", or Borges' "Garden of Forking Paths" provide familiar examples. This work interrogates our everyday notions of time, reality, and order in much the same way as Cubism in painting and Dada in theater[5].

In electronic literature, hypertextual variation of story has not proved fruitless. In some works, the reader is invited to identify with a character and led to desire to achieve a specific story, such as survival or a happy ending. We call such work a *game.* Alternatively, if the reader finds it difficult to advance the narrative from its current state — as when she is caught in a maze of twisty passages, all alike — we call the work a *puzzle.* Games and puzzles have proven to be popular and profitable electronic entertainments. The claim of games and puzzles to expressive power seems thus far to be tenuous, but see [34] and [42] for contrary opinions.

4.1 Coherence, Perfluence, And Their Discontents

The most determined critics of early hypertext narrative, both within the hypertext research community [29; 45] and outside [33] [19] have been chiefly concerned with incoherence, arguing that the malleability of story necessarily transforms the text into an empty puzzle or a tarnished slate. In Miller's case, hypertext indeed is merely a placeholder for all of postmodernism (and, perhaps, a good deal of modernism). Coover [8] argued that hypertext was attractive because it helped writers to subvert the tyranny of the narrative line, and Miller in turn denounced hypertext to defend that line. On a technical level, Zellweger et al. are concerned that the narrative remain internally consistent — that it not contradict itself — and that the essential elements of the story will in fact be seen by the reader. They reject malleability of story as incoherent and prize *coherence*, by which I mean consistency of the story within and across readings.

It is striking to observe that, despite the prominence of this debate in the hypertext literature, few of the better-known hypertext narratives actually possess malleable stories. *afternoon* may, but only if the reader is fooled into concluding that the story has ended when, in fact, there remains much more to say [9] [44]. *Victory Garden* has a single counterfactual coda. *Patchwork Girl* seems to me to be coherent, though (like its protagonist) stitched together from disparate fragments. "Lust" is hard to decode (and perhaps is not narrative) but it insistently proclaims its own consistency, repeating again and again that there is a man, a woman, they are nearly naked, that there is blood, and a knife. "In Small & Large Pieces" is a coherent story refracted (because it is inverted in memory). So, too, are the tableaux of Deena Larsen's *Samplers.*[6]

Concern over coherence in hypertext is often accompanied by a desire to recapture *perfluence*, the immersive state of mental visualization that is the hallmark of one kind of naturalistic fiction[7]. In *The Art of Fiction* [12], John Gardner argues that

> *The most important single notion in the theory of fiction . . .is that of the vivid and continuous dream.*

Print must of necessity outrun hypertext in the quest for a continuous dream, since hypertext is necessarily interrupted by reflection: the hypertext reader must ask, "which link shall I choose?" where the print reader need merely turn the page. But mere continuity of experience is not the only aesthetic good; we sometimes prize fine description or perceptive observation, for example, even though in doing so we focus on the craft of the writer or on our own experience.

The quest for perfluence, for immersive and engaging hypertexts, often claims to be an effort to reclaim coherence. Its actual opponent, however, is not the use of hypertext to change the story, but rather the much more characteristic and effective use of links to alter the plot.

5. CHANGING THE PLOT

Bolter and Joyce [17] first made the crucial observation that using links to vary the *story* appears less promising than using links to vary the *plot.* Many stories interest us because events happened as they did. Hamlet *might* have gone back to school, Juliet *might* have had a long talk with her mother, Oedipus *might* have told the messenger to go home, Winston Churchill *might* have been killed in 1931. Changing the story in these cases is futile; the world is full of unhappy sons, precocious daughters, officious rulers, and wayward taxis [10]; these tales are interesting only because of the specific particularity of their story. Historians and journalists, though they may be mildly interested in counterfactuals,

[5] Lanham [25] discusses the postmodern interest in oscillation, in the uncertainty that arises from attempting to reconcile presentation and story when the presentation itself becomes the story or when it contrives to cast doubt on the story itself. Gaggi [11] remains the best guide to postmodernism in hypertext and its relationship to other media.

[6] A further objection raised by hypertext critics is that hypertexts are inaccessible, that they amount of work they demand from the reader. Aarseth [1], to be sure, sees *work* as inherent in cybertext, of which hypertext narrative is an example: since hypertexts demand rereading and hypertextuality can only be perceived through rereading, and as the experience of hypertext reading demands reflective choice of links, hypertext demands an active reader in a way that other media may not. But the demands of the hypertexts discussed here, and deplored by some critics, may owe as much to their artistic milieu as to the needs of the medium: these writers, working at this time, could not have been recognized for work that was *not* a challenge to the reader; compare, for example, winners of the Nobel Prize for Literature during this period.

[7] And also of some approaches to cinema, painting, and sculpture.

necessarily place special emphasis events that actually transpired. Here, again, one story has significance that its variations necessarily lack. Technical writers are chiefly interested in narratives that describe a specific story – the desired or recommended procedure – whether explaining a protocol for heart valve replacement or the procedure for updating an operating system.

Links may vary the *plot,* on the other hand, in many significant and useful ways. We may use links, for example, to switch among different points of view, providing multiple perspectives on the same unfolding actions. "Patterns of Hypertext" calls this the Rashomon pattern [3]. Links may shift in time, letting us interpolate into a scene its antecedents or its consequences [44]. Links may shift in place, permitting us to view simultaneous events that occur in different places, and links may permit the writer to vary pacing, providing more or less detail or interpolating intertextual commentary. In all these cases the *story* – the underlying events being narrated – may remain unchanged; what changes is how, when, and whether these events are described[8].

Discussion of hypertext narrative has usually centered on fiction, invented narrative in which the author, at least in principle, may design and revise the story to meet her needs[9]. It may be more profitable instead to contemplate the challenge of historical narrative. The student of modern history, in particular, soon learns that it is impossible to narrate everything that can be known, and that no single narrative strand or sequence will meet all needs or satisfy all audiences. If we intend to describe the Battle of Gettysburg or the Decline of the Roman Empire, we will never have space (and the reader will never have patience) for every pertinent incident. Nonetheless, we believe there *is* a underlying story: the battle happened, the Western Empire fell. Even where some incidents are unknown to us, we confidently know that they took place; we may not know exactly where Gen. Doubleday was at 1pm on July 2nd, but we can be reasonably confident that he was somewhere, that he was not in two places at once, that to get there he either walked or rode a horse, and so forth[10].

Changes in plot, without changes in underlying story, exert powerful effects on our understanding of the material. These are not (as some hypertext critics mentioned above seem to have assumed) merely a matter of abstruse artistic effect. Consider, for example, some familiar cinematic accounts of the allied invasion of Normandy in 1944:

- The Longest Day
- The Big Red One
- Saving Private Ryan
- Band of Brothers

These films draw on the same reservoir of story; what happens on Omaha Beach and Ste-Mere-Eglise does not change much from one film to another. But by changing tone, pacing, point of view, by starting and ending the account at different places, and by embedding the narrative in different frames, the authors create entirely disparate arguments.

5.1 Plot And The Cycle

Hypertext structure is perceived through *recurrence.* The cycle, not the branch, goto, or jump, is the central hypertext structure [3]. Cycles were once thought to be defects, to reflect the reader's confusion or the writer's incompetence. This view was wrong: we cannot dispense with cycles. Even if we do compose an acyclic hypertext, we can appreciate it as a hypertext only by returning to the start and reading it again. Moreover, we need to approach the task of writing an acyclic hypertext with great care lest combinatoric explosion exhaust our creativity and patience. We cannot hope to offer even the illusion of free will by anticipating all the options that an imaginative reader might invent and responding to each with yet more choices [30]. Recurrence is the essence of hypertext[11].

It might seem that plot structure is mere art and artifice, that essential meaning lies in the story rather than the plot. That plot is deeply meaningful can be demonstrated with ease. Consider, say, the story of "Little Red Riding Hood" (Arne-Thomson 303), in which a wolf deceives a young girl into climbing into bed with him[12]. The girl initially sets out to visit her grandmother; before the girl arrives, the wolf has already consumed the defenseless old lady. In some tellings, we disclose this crucial information early: "meanwhile, as Little Red Riding Hood strolled through the forest, the wolf had already arrived at her grandmother's cottage." In this case, when the girl arrives the reader knows what is about to happen: we find ourselves in a horror movie, appalled at the foolishness and fate of the heroine. In other tellings, we might withhold this information, and the reader is as shocked as the girl

[8] Not every event in a story need be described for it to be understood by the reader; if we see the beginning and the end of an action, we can frequently extrapolate the course of action without further help. At times, it may be sufficient to show only a part of the action because, having seen that part, we can reasonably extrapolate how it came about or what must happen next. We cannot, in any case, describe the underlying story exhaustively – there are always things we'll have to leave out – and some narrative decisions may require us to describe events that other decisions would render superfluous. If we recount the hours before Pearl Harbor from the perspective of an American aircraft mechanic, his immediate circumstances need to be described. If we describe the same events from the perspective of Admiral Yamamoto, the mechanic's adventures might be left out.

[9] But see the pioneering work in the rhetoric of creative hypertext nonfiction by David Kolb [21] [20] and George P. Landow [23].

[10] In fiction, we can reconcile discrepancies in continuity through fanciful though improbable conrivance; when a bartender in Coover's collaborative *Hypertext Hotel* was described by one writer as blonde and by another as dark-haired, the error was patched by creating a room where an alien device manufactured bartenders to order. Historians, in general, have a more limited repertoire of remedies.

[11] And also, of course, the essence of music.

[12] Reading this sentence, you may object that this is not quite the "Little Red Riding Hood" you remember. But of course it is: the dénouement, surely, is that the girl climbs into the wolf's bed, and that's exactly how you understood the story when you were three. It may seem different now, as the significance of the action has changed. This demonstrates the power of variation in plot. The role this footnote plays in interrupting the narrative and thereby calling attention to this phenomenon is intended as a second demonstration.

to discover that things are not what they seemed and that the universe can turn upon us so unexpectedly and so viciously; we find ourselves in comedy (if this turn leads to further complication) or romance (if Little Red Riding Hood's intrinsic goodness saves her in the end) or melodrama (if she is rescued, and married, by the brave woodsman) or perhaps in tragedy[13].

A film must usually choose one plot or the other, but a hypertext can contrive to tell both.

6. NONCE UPON SOME TIMES

In his essential essay "Nonce Upon Some Times" [32], Michael Joyce approaches the use of links to vary the plot not, as I have done above, in terms of the mechanics of narrative – the way links transfer (and dissipate) energy and narrative momentum through shifts of sequence, pacing, and point of view – but instead in terms of narrative structure and rhetorical form. Where I have emphasized the use of links to regulate *how* events are described, Joyce builds a taxonomy to explain *why* connections are wrought.

Joyce begins with a description, couched as a writing workshop exercise, of a narrative sequence of four writing spaces (lexia, nodes). We might imagine, for example, the following sequence[14]:

1. A wealthy and handsome boy, returning from an isolated outpost, embarks on a ship and encounters a beautiful girl who, it happens, is a con artist.
2. They meet. As is his nature, he falls in love. As is hers, she swindles him out of a large sum of money.
3. He discovers that he was been swindled; the lovers quarrel. She discovers that she has fallen in love with him. They part, and do not see each other for a long time.
4. The estranged lovers meet again.

In our hypertext, we next revisit node 2 — their first romantic meeting — and then the reading will proceed from there. Joyce asks, "what new node follows our recurrence to node 2?" We can identify exactly three distinct alternatives:

1. We follow once again the cycle, either literally — viewing the same sequence a second time — or in a new variation. We call this *recursus.*
2. We proceed through the recollection of node #2 to a fifth node that follows naturally from the first four. Having met again, we recall the glow of love, relive those precious memories, and seizing the moment live happily ever after. Or, having met again and considered those wonderful memories, so bittersweet, we recognize that we can't go home again. We call this *timeshift:* we revisit the scene of our first love because now it means something new and that knowledge is crucial to understanding what happens next.
3. We proceed through the recollection of node #2 to a new node that, far from following naturally from the first four, takes off in a direction that no one could have anticipated, We call this *renewal.* As the lovers recall the glow of love, once utterly lost and now (perhaps) rekindled, a submarine periscope is sighted off the starboard bow.

This structural motif – recurrence introducing recursus, timeshift, or renewal, is not merely a characteristic of love stories, romantic comedies, or the work of Michael Joyce. It will be found in any meaningful hypertext reading. Suppose, instead of exploring romance, we have set out to instruct the student in the principles of preparing stocks for the kitchen.

- We might begin by describing *why* we would want to make stocks, perhaps by describing the variety of useful and delicious sauces we can derive from a well-made dark veal stock.
- We next describe the ingredients of dark veal stock — veal bones, onion, carrot, celery, water — their selection and initial preparation.
- We might turn now to the preparation itself: roasting the bones, caramelizing the *mirepoix*, gently simmering the ingredients in cold water, skimming off impurities.
- We next describe the *taste* of the finished stock, with reference to the ingredients, to our initial description, and the various purposes we intend.

Here, again, we have recurrence, revisiting a previous node. And once again, after the recurrence, we may proceed to *recursus* (preparing white veal stock, chicken stock, fish stock, vegetable stock, demi-glace, consommé), to *timeshift* (the central role of stock in the development of classical French cuisine, the work of Carême and Escoffier, the impact of *nouvelle cuisine*), or to *renewal* (shortcomings of flour-thickened sauces, *jus lié* and contemporary sauces, foams, emulsions, molecular gastronomy).

Joyce calls these moves "the three link primitives", and observes that each primitive offers important variations.

> *That there are three link primitives does not speak to their myriad types of course. Of recursus, there is hallucination, deja vu, compulsion, riff, ripple, canon, isobar, daydream, theme and variation to name a few. Of timeshift there is the death of Mrs Ramsay and the near disintegration of a house, the chastened resumption of the Good Soldier, 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, the unrecollected whisper of your mother, and the barely discerned talk of lovers overheard at the next table as they eat potstickers and drink bad Chinese beer.*

We may add to Joyce's primitives one further class of link, *annotation,* which includes expanded exposition, definition, anecdote, intertextuality, reflection, lyric [43], and footnote [13][15]. Joyce's original exercise postulates that each link advance the narrative (though, in requiring recursion, we advance the narrative by stepping backward in the text). To be sure, we must sometimes advance the plot; if we do not, we are not narrating. Nonetheless, various forms of annotation appear frequently in hypertext

[13] Insistence on the reader's right to free and knowing navigation [39] requires that we forego this sort of plot variation. I believe this too great a sacrifice. If the reader is to make a free and knowing choice, she must know its consequences: the reader must already know and understand the story. See Note 12.

[14] Joyce's example is even more schematic: boy meets girl, they fall in love; they quarrel; they reconcile. This particular variation is Preston Sturges, *The Lady Eve.*

[15] Annotative links offer material that is integral to the work but that lies outside the narrative, rather than notes added by a reader. See, for example, the whale lore of *Moby Dick.*

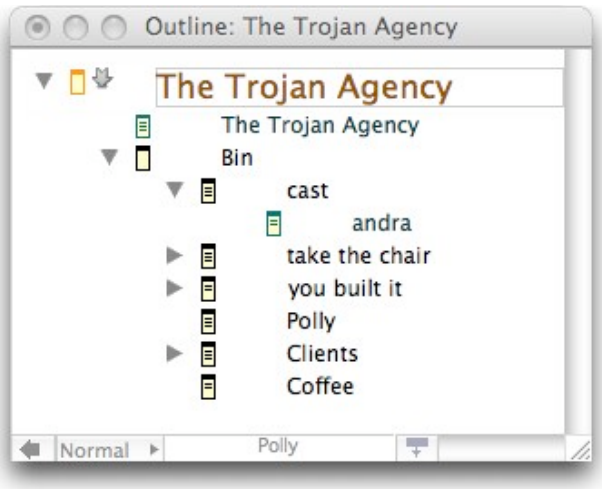

Figure 2. Outliners are currently the most familiar form of stretchtext. Clicking a disclosure triangle is, in effect, traversing a link; in contrast to navigational hypertext, the surrounding context persists.

narrative and cannot easily be treated as examples of recursus, timeshift, or renewal. Annotation is particularly characteristic of stretchtext, which we will discuss shortly, and plays an important role in early hypertext rhetorical analysis because its rhythm of arrival and departure [24] is clear and explicit.

> **Proposition 2: the four fundamental links in narrative are recursus, timeshift, renewal, and annotation.**

6.1 Work

We want hypertext narrative to be valued. In practice, this has meant that it either must compel respect because it is frequently demanding ("ergodic" in Aarseth's term) or that it must be wildly profitable. This imperative stems not from any property of hypertext, but from the constitution of the military-entertainment complex [37] and its academic counterparts.

We should not mistake the choices made by individual writers for the inclinations, much less the constraints, imposed by the medium. Facile generalizations can easily mislead. If our experience of cinema, for example, were based entirely on the movies shown by certain film societies, we might think cinema to be intrinsically ergodic and Hollywood an exceptional, if intriguing, liminal practice. The "ergodic" nature of early literary hypertext was dictated not by the nature of the medium, but by the social and economic milieu in which it arose. The serious hypertext fiction of the 90's could not be at once transparent and serious, for the critical imperative of literary fiction demanded challenge and active reading.

The indictments leveled by intelligent critics at hypertext narrative have been these: that it is incoherent; that it is insufficiently engaging; and that if it is narrative it cannot be a hypertext and, if a hypertext, in cannot be a narrative[16]. If we find these arguments convincing, we may either abandon the effort or seek to remedy the fault[17].

The remedy for engagement has generally been to move toward cinema, television, or computer games, with solutions ranging from illustration to the Holodeck.

The technical solution proposed for the other objections has, generally, been stretchtext [39]. Where link traversal in conventional hypertext changes the entire textual state (e.g. opens a new Web page), following a link in a stretchtext modifies a local context (e.g. expanding an outline item).

Stretchtext promises several advantages. As Joyce [18] observed, navigational hypertext can seem a shifty and unstable:

> *Print stays itself; electronic text replaces itself.*

Stretchtext, in contrast, remains in place; if less solid than print (or stone inscriptions), it can present a reassuring stability. In addition, replacing an entire page can be a time-consuming process — especially if network latency in involved, as is generally the case for Web hypertexts. Stretchtext can easily by loaded in a single (compound) document and gradually disclosed, with link traversal animation unconstrained by unpredictable page loading and formatting delays.

7. STRETCHTEXT AND NARRATIVE

In a navigational hypertext environment such as Storyspace or a simple Web page, we choose a link and the current page is replaced by a new page.

> ABC DEF ⇒ GHK LMN

Here, letters represent passages of text (or other inline elements) arranged in a column or stream of text, spaces delimit blocks, and underlined elements represent links with which the reader interacts. In conventional hypertext, a link takes us to a new place with new text; "electronic text replaces itself."

A series of Web pages may assert a relationship by presenting elements, such as a header or sidebar, that are repeated across pages:

> ABC DEF + P Q ⇒ GHK LMN + P Q

Alternatively, we might use AJAX to replace some parts of the page dynamically while notionally remaining "on the same page:"

> P Q + (ABC DEF ⇒ GHK LMN)

[16] Several other objections that need not detain us include the observation that hypertexts lack the feel and smell of the codex book; that the computer screen is difficult to read in bed or in the bathtub; that kids today don't read and would prefer to play games; that hypertext is complicit in postmodernism.

[17] Zellweger et al. [45] criticize what they experience as the fragmentation of Storyspace narratives and argue that stretchtext will prove more genial for crafting immersive narratives, "the modes of reading associated with escapism and so-called "ludic reading," where we become fully immersed – 'lost in the book.'" They assume, wrongly in my opinion, that the opacity of texts like *afternoon* derives from their hypertext model and not from the aspirations of their authors. Their claim that fluid text provides better support for character development strikes me as unconvincing, and their emphasis on expandable exposition as an opportunity for character sketches contradicts Elmore Leonard's famous dictum about *hooptedoodle* [26] while trying to claim Leonard's native land, the plot-driven mystery story, in the name of fluid text.

Stretchtext seeks to restore stability to the hypertext by further limiting the scope of the change. For example, a replacement button in GUIDE [6]is a link that is replaced with an expanded version of itself in context.

A<u>B</u>C ⇒ ADEFC

In many implementations, clicking the expanded version restores the original text.

A<u>B</u>C ⇔ A<u>DEF</u>C

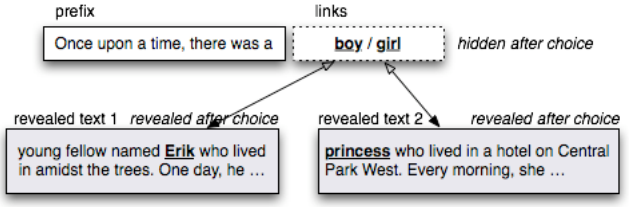

Figure 3. Stretchtext *choice* link implements the familiar split/join pattern (17).

A glossary link or "tool tip" reveals new text in a separate stream — in the margin, perhaps, or in an auxiliary window.

A<u>B</u>C ⇔ A<u>B</u>C + DEF

An outliner is simply a collection of replacement buttons

<u>▷</u>A ▷B ⇔ <u>▽</u>A ▷1 ▷2▷B

where ▷ and ▽ represent iconic glyphs in the text stream. Replacement links in this way form an implicit tree which the reader may traverse, even if the tree is not explicitly presented as an outline. Hypertexts constructed in this stretchtext formalism have no cycles, and the absence of cycles is argued to be a virtue [7; 45].

Not only does stretchtext avoid cycles, but it essentially prohibits most variation in plot. Consider two elements X and Y that might, in some readings, appear in the text stream. If Y follows X in some reading, Y will follow X in every reading in which they appear. Thus not only must we forego cycles, we must always adhere to the same narrative sequence. Our range of plot variation is thus considerable restricted.

Proposition 3: conventional stretchtext greatly restricts plot variation

We might, of course, create a second distinct lexia, W, which will contain the same text as X. In this way, W might appear early in the reading, and X might appear late in the reading. This provides for some plot variation, at the cost of duplication of effort and maintenance. But this duplication is seldom useful outside of mere annotation, because if W and X have outbound links, the destinations of those links must *also* be duplicated, Indeed, the transitive closure of the outbound links from X must all be duplicated in W; this soon becomes intractable.

We may instead provide *labile* lexia — stretchtext elements that move in the text stream as they are required[18].

A <u>B</u> C ⇒ A <u>B</u>X C

A B <u>C</u> ⇒ A B <u>C</u>X

Labile lexia give rise to a new and powerful generalization of stretchtext.

7.1 Generalized Stretchtext

Stretchtext has often been presented as a remedy for the ailments of navigational hypertext. In the pioneering era, the chief peril was thought to be disorientation (for which see [2] and [22]), while more recently the danger has been seen as incoherence or postmodernism induced by variation of story or plot. I have argued above that we cannot dispense with variation of plot in hypertext narrative; the defense of stretchtext from this critique has been made difficult because available exemplars seem so slight[19].

We can, however, capture the full flexibility of Storyspace-style hypertext within the stable framework of stretchtext by expanding the stretchtext formalism. We begin with two text streams, one visible to the user and one hidden from view.

A B C + [D E F …]

Brackets [] indicate that the elements in the stream are invisible to the user. The familiar stretchtext constructs remain available

A<u>B</u>C + [D E F …] ⇔ A<u>DEF</u>C + […]

And may readily be extended in the usual way:

A<u>B</u>C ⇔ A<u>DEF</u>C ⇔ AD<u>E</u> GHJ FC

The hidden stream thus provides a reservoir of labile lexia from which links may draw, and to which link traversal may return passages to be hidden from view.

The stretchtext example above is the familiar *expanding element*; traversing the link expands the lexia to add more information. We may also find it useful to define the *replacing element,* where traversing the link irreversibly[20] replaces the link anchor (and perhaps some adjacent text) with entirely new text.

A<u>B</u>C ⇒ ADEFC

A(<u>B</u>C)G ⇒ ADG

A series of replacing elements create a *choice*:

A<u>B</u>C D ⇒ AE D

AB<u>C</u> D ⇒ AF D

Selecting either link B or link C replaces both links (and perhaps their surrounding text) with a new text, either E or F.

[18] GUIDE called these *definition* buttons, hoping that they would be limited to simply glosses that would be used at multiple sites in the document rather than opening the door to plot variation and – even worse – to cycles. Even so, they were introduced as a misfortune in a transition from the section, "relationship between research and product" to its successor, "purity lost."

[19] The primary FLUID text seems to have been *Harry The Ape,* a short and unpublished childrens' story. Moulthrop's *Victory Garden* includes a long stretchtext passage. Morrisey's "The Jew's Daughter" [35] is perhaps the most artistically successful stretchtext fiction, though it is not a hypertext; see also [36] and Ian M Lyon's "TextStretcher" [28].

[20] Reversibility in terms of "normal" reading. We may provide a "back" button or navigational undo that returns us to the previous state, but in using the facility we step out of the typical reading mode, much as going back to a previously-read page (or skipping ahead to the end) is part of the affordance of the codex book yet lies outside the expected or typical reading procedure.

Finally, a *jump* moves a designated lexia from the hidden stream to the visible stream, placing it after the block that contains the current link.

$$\text{A}\underline{\text{B}}\text{C}\ldots.\ \text{DEF}\ [\text{WXYZ}] \Rightarrow\ \text{ABC X}\ \ldots.\ \text{DEF}\ [\text{WYZ}]$$

$$\text{ABC}\ldots.\ \text{D}\underline{\text{E}}\text{F}\ [\text{WXYZ}] \Rightarrow\ \text{ABC}\ \ldots.\ \text{DEF X}\ [\text{WYZ}]$$

More generally, the jump could also replace the link anchor, or its context — that is, some of the text preceding or following the anchor itself[21].

The jump, significantly, restores the possibility, always present in navigational hypertext, for the same passage to appear at entirely different pointsof the reading. X may appear before D in some readings and after D in others. We may construct cycles in which X occurs (though we may choose to construct acyclic hypertexts).

If the link mechanism also provides a conditional mechanism equivalent to guard fields, the jump gives us formal equivalence to Storyspace hypertexts while retaining the textual stability of stretchtext. The same mechanism appears formally equivalent to iHTML's intensional transclusion [40]. Intensional hypertexts are usually viewed as versions or variants, such as French and English editions of a technical presentation, and so emphasize delivering the most appropriate version to a reader. Their document state tends to reflect overt preferences, such as her choice of language, while we use the same formal tools to reflect the state of the plot.

Network latency poses an obstacle to fluent Web narrative, as loading a new page may inflict a long and unpredictable interruption on the reader. Generalized stretchtext can avoid this interruption, either by fetching the jump text discretely through a fast AJAX interaction with the server or by preloading the entire document, including the hidden lexia, and manipulating the DOM and style assignments to reveal the hidden lexia when required.

8. THE READING ENVIRONMENT

To create a hypertext system that supports generalized stretchtext, we require a reading environment, in which the hypertext will be performed, and a writing environment in which the hypertext may be created and revised.

A prototype reading environment may readily be constructed in javascript, using http transport and relying on standard Web browsers to provide formatting.

The limitations of building what is, in essence, a new hypertext system within the Web browser are less confining than might be expected. First, modern javascript exceeds its reputation both in expressiveness and performance. Javascript — and the DOM — are now sufficiently well standardized that a single implementation will suffice for a fairly broad range of platforms. Performance, which we might expect to constrain our ambitions, is already good, and the popularity of AJAX has directed great resources into optimization of javascript interpreters. Finally, progressive enhancement [14] helps overcome lapses in implementation while helping to promote preservations.

[21] In principle, we could allow stretchtext links to make arbitrary transformations to the text. It seems desirable, however, to emphasize transformations at or near the link anchor; in particular, if the transformed text is remote from the anchor, the reader may not be aware of the effect of choosing a link.

For example, consider a simple annotation link — a link that offers a footnote or reference to optionally ornament the main text. If we implemented this directly in the markup,

```
<a href="#"
onclick="reveal('footnote_1')">
[1] </a>
```

then our script would fail completely should the function `reveal` be absent (because javascript is disabled) or unavailable (because the language understood by the browser is not the language we expected – perhaps because the browser implementation is years or decades in the future). Instead, we write

```
<a href="/failure.html"
class="footnote footnote_1">
[1] </a>
```

When the page is loaded, a script can readily traverse the document looking for links (or other nodes) that possess the class `footnote`, remove the link to "failure.html" and add a suitable `onClick` method. This approach yields a variety of significant benefits:

- Details of presentation (such as where the footnote text appears) are separated both from implementation (such as the name of the function that reveals the footnote), representation (such as whether the footnote text is stored as hidden text in the current document or is to be fetched separately from the server), and typography.
- Simpler HTML is more easily generated and maintained by the writing environment.
- Should the reading environment fail — either because some scripts or stylesheet cannot be found, because changes in the computing environment render them invalid, or because we have not yet written them correctly — we still have a legible initial state with a link to a page that might provide useful information for readers, archivists, or future editors. Under normal circumstances, of course, the reader will never see the failure page.

9. THE WRITING ENVIRONMENT

The difficulty of creating a reasonable writing environment has long constrained the development of new hypertext systems [30] and inhibited the creation of new hypertexts. Early experiments in Fluid, for example, were laboriously constructed using Microsoft Word's outliner [45], a practice the designers found makeshift and unsatisfactory:

> *The ability to see paths and read along them easily is central to viewing a complete idea in a fine-grained hypertext. It is thus needed to support the construction of grammatically-correct sentences across fine-grained node boundaries, as well as proofreading. This ability is also central to following a particular narrative progression amid the branching alternatives.* (p. 48)

Instead of constructing an ad hoc editor, we write in Tinderbox [5]. a general-purpose hypertext tool that offers a familiar hypertext writing experience derived from Storyspace [4] and VIKI/VKB [41] [31]. Tinderbox offers a very flexible template-based XML export mechanism; the writer works in a familiar node-and-link hypertext environment with many separate lexia,

and then exports the document into an automatically-assembled xHTML file.

When this file is loaded into a browser, a javascript preprocessor walks the document tree, adding behavioral scripts to link elements. This reduces the size and complexity of the exported file while introducing a useful layer of indirection; the xHTML file from Tinderbox specifies the desired behavior by assigning CSS classes to elements and the javascript onLoad method takes care of actually assigning suitable method handlers to the corresponding document elements.

A stretchtext page is, in the terminology of the Halasz Seven Issues [15], a composite node, and we represent each stretchtext element as a composite of two or more Tinderbox notes. For example, a simple *expander* presents a link anchor; when the anchor is clicked, we will add additional text after the expander. If the anchor is clicked again, we remove the additional text. We represent the link anchor as a Tinderbox macro:

^do(expander, *anchor text*)

and place the additional text in a separate note, a child of the expander.

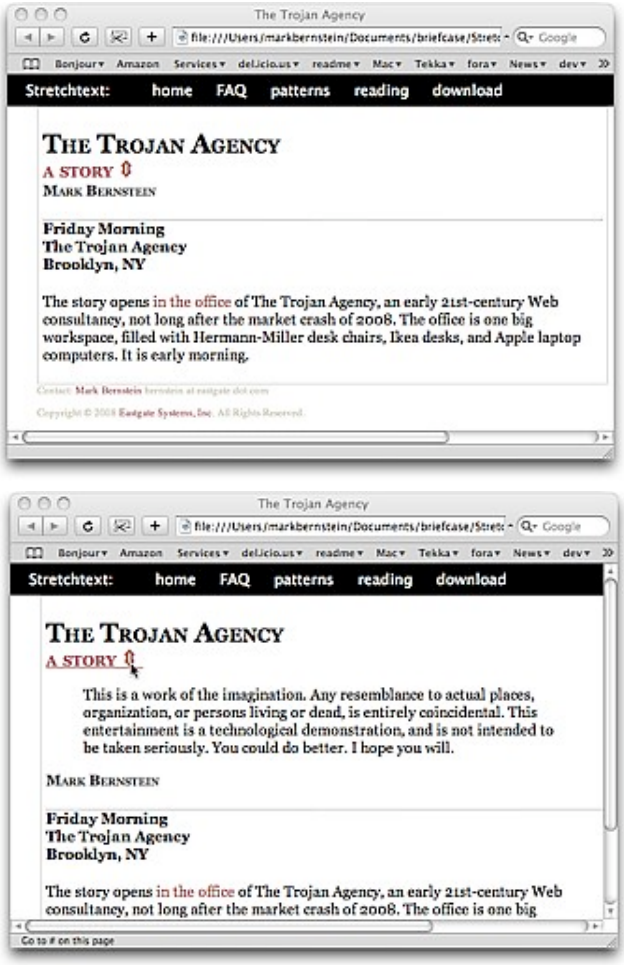

Figure 4. Clicking the expander link ⇕ reveals additional text.

Note that the child note(s) may contain further links, to arbitrary depth.

10. CONCLUSION

If hypertext narrative is to attempt what we cannot achieve in print, link choices must have consequences. Links may vary story, plot, or presentation, but the most interesting and useful realm of variation in hypertext narrative is frequently plot. We perceive this variation, as we perceive all hypertext structure, through recurrence: by revisiting (parts of) a hypertext that we have read before and making new choices, we learn what the hypertext can do and what it resists. A recurrence will be followed by one of four fundamental classes of link: recursus, timeshift, renewal, or annotation.

Hypertext narrative is not inherently incoherent, and its ergodic nature may well result as much from the circumstances of its production as from its inherent tendencies.

One source of resistance to hypertext, and indeed to all electronic reading, is its instability: "*Print stays itself; electronic text replaces itself.*" That instability has often been addressed by using stretchtext to reduce or eliminate the familiar navigational link. Conventional stretchtext, however, greatly restricts variation in plot. By introducing the *jump* as an implementation of labile stretchtext lexia, and augmenting stretchtext with dynamic links or guard fields, we can recapture the expressive power of familiar, navigational hypertext within the stable framework of stretchtext.

Implementing prototype hypertext reading environments can now be done using standard Web components, even for formalisms like generalized stretchtext that do not closely follow the model of the conventional Web hypertext. Similarly, off-the-shelf hypertext tools can facilitate writing in the new systems, even when the systems themselves are incomplete or undergoing rapid change.

Generalized stretchtext systems thus require and exploit more complex text transformations that the simple replacement link or disclosure triangle. Enacting these transformations without undue distraction remains a challenge, but understanding the vital importance of these new transformations may now permit fresh progress in stretchtext narrative.

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