Designing Hypertext Tools to Facilitate Authoring Multiple Points-of-View Stories

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ABSTRACT

How can authoring tools help authors create complex, innovative hypertext narrative structures? Tools for creating hypertext fiction typically represent such narratives in the form of nodes and links. However, existing tools are not particularly helpful when an author wants to create a story with a more complex structure, such as a story told from multiple points of view. In this paper, we describe our work to develop *HypeDyn*, a new hypertext authoring tool that provides alternative representations designed to make it easier to create complex hypertext story structures. As an initial exploration, the tool has been designed to support authoring of interactive, multiple-points-of-view stories. In order to describe the tool, we describe a simplified transformation of *Rashomon* into a progressively more interactive narrative. Along the way, we identify useful new representations, mechanisms, and visualizations for helping the author. We conclude with some thoughts about the design of interactive storytelling authoring tools in general.

Categories and Subject Descriptors

I.7.2 [**Documents and Text Processing**]: Document Preparation—*Hypertext/Hypermedia*; H.5.4 [**Information Interfaces and Presentation**]: Hypertext/Hypermedia

General Terms

Design, Human Factors

Keywords

interactive storytelling, hypertext fiction, authoring tools, representation, multiform stories, rashomon

1. INTRODUCTION

How can authoring tools help authors create complex, innovative hypertext narrative structures?

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There are a number of different ways in which nodes within a hypertext may be structured. Nodes may be linked in a linear sequence, may form a tree-like hierarchical structure, a more general directed acyclic graph, or an arbitrary graph which may include cycles and loops [25]. Tagging or categorizing groups of nodes within a hypertext can create secondary structures within a work. There may also be specific *paths*, either explicitly created by the author, or implicitly created as the reader traverses the work. This ideas of paths or trails can be seen as far back as Bush's discussion of the *Memex* [7].

Tools for creating hypertext fiction typically represent such narratives visually as nodes and links. Authoring a work in a node/link tool generally consists of creating nodes, populating those nodes with text, and then creating links between the nodes. The tools are intended to make it easy for authors to create, change, and visualize certain kinds of relationships. But this process can be challenging, with authors having to maintain a mental model of the relationship of the various text nodes to the overall document structure [14].

The remainder of this paper is structured as follows. We provide a brief review of the kinds of narrative structures supported by existing hypertext authoring tools. Then, we describe a famous example of a "multiform" story [20] (i.e., a story told from multiple points of view) – *Rashomon* — and illustrate how it would look as an interactive story using typical hypertext authoring tools. We then describe some of the things one would like to do as an author of an interactive version of such a story. We then describe our hypertext authoring tool, *HypeDyn*, that provides additional representations of hypertext to support the authoring of interactive, multiple-points-of-view stories. We conclude by discussing some of the implications for designing tools to support interactive storytelling.

2. RELATED WORK

In this section we give an overview of some of the ways in which hypertext can be structured, and summarize the ways in which existing hypertext authoring tools support different kinds of hypertext structures. In general, existing tools are not particularly helpful when an author wants to create stories with complex structures, such as a story told from multiple points of view.

Existing tools help hypertext authors in a variety of ways. Although earlier tools, such as the *Hypertext Editing System*

[23] and *FRESS* (File Retrieval and Editing System) [24], allowed authors to create links between text nodes, there was no explicit notion of a map view of the hypertext structure. *Hypercard* [8] used a card/stack metaphor, with authors creating links between cards within a stack of cards. Currently, the standard approach taken by hypertext authoring tools is to explicitly represent the nodes and links of the hypertext work in a "map" view (e.g., *Storyspace* [4], *Intermedia,* [9] *Tinderbox* [5] and *Notecards* [22]). Tools such as *Storyspace* often provide several alternative views of the work, such as a chart view, an outline view, and a "treemap" view. These views provide representations which help authors to visualize the structure of the text as it is being written.

Modern website development tools, such as *Dreamweaver* and *Expression Web* (formerly known as *FrontPage*), include some visualization of the structure of a website. However, most of these tools emphasize a hierarchical structure, which can be seen as a subset of the more general node/link representation of tools such as *Storyspace*. Although not explicitly designed for hypertext, many hypertext and hypermedia systems have been built using either *Flash* or *Director*. Both of these tools use a "timeline" metaphor, adapted from video editing tools. In timeline-based systems, links allow the reader to jump to different "frames" within the timeline. As with card/stack tools, there is no explicit representation of the node/link structure.

The nodes within a hypertext can be classified as those which contain fixed content and those which allow for variable content. Most traditional hypertext systems, such as *Storyspace*, only allow for fixed content. Others, such as *KMS* [1], *Hypercard* and *Notecards*, can have computationally-generated content. Interestingly, the most popular hypertext fiction authoring tool, *Storyspace*, does not provide for variable content at the node level. Web-based hypertext nodes can also contain dynamic content, although this depends on the authoring system used, the back-end technology, and the browser.

Some systems also provide conditional links (what *Storyspace* calls "guard fields") or links which trigger some computer code which determines the destination of the link during run-time based on some underlying representation of the nodes and their relationships [15, 10, 13]. Other systems, such as Microcosm [11], Auld Leaky [16] and AHA! [17] take this a step further, with a concept of "generic" links which are dynamically associated with nodes at run-time, leading to what is sometime termed "sculptural hypertext" [3, 6]. These more dynamic, procedural approaches add complexity to the structure of a work and push up against the genre boundaries between procedural and non-procedural works.

A good example of the incorporation of both conditional links and dynamic node content is *ConnectionMuse* [13]. *ConnectionMuse* provides the ability to define both "conditional links" and "conditional text" which change destination and content based on the reader's past actions. The system consists of a set of extensions to *Dreamweaver* which allow the author to embed scripts in an HTML file to represent the conditional links and conditional text.

3. PROBLEM STATEMENT

Existing hypertext authoring tools, with their use of a map visualization which explicitly represents the basic node/link structure of hypertext, afford a certain way of thinking about authoring hypertext. These tools make it quite easy to represent the nodes within a hypertext, and to specify the links between these nodes. Visualization and representation of, for example, hierarchical or acyclic structures is very straightforward. However, these structures are not the only ways in which hypertext fiction can be organized.

Bernstein [2] has identified many patterns which occur in literary hypertext, such as cycles, counterpoints, mirrorworlds, montage and the split/join. Patterns such as cycles and split/joins can be seen in classic hypertext fictions such as Joyce's *afternoon, a story* [12]. These complex structures are ones which "[do] not reside exclusively in the topology of links nor in the language of individual nodes" [2], but rather emerge from both the topological and rhetorical structure of the work. As Bernstein observes, the inability of current hypertext authoring tools to represent more complex structures, such as the mirrorworlds and montage, makes it difficult for authors to perceive, manipulate and understand these patterns in their writing.

One example of complex structure can be seen in stories in which multiple characters tell the "same" story from multiple perspectives, what Murray calls a *multiform* story [20]. In such a story, the author would like to be able to identify, for example, the similarities and differences between the various versions of the story, and have these characteristics visualized in the representation of the hypertext within the authoring tool. The multiform story, which Bernstein sees as a combination of a cycle and a split/join [2], is an important form for hypertext fiction, and can be seen in many works, perhaps most notably in Joyce's *afternoon, a story* [12].

An example of a tool which attempts to support this type of complex hypertext fiction is *ConnectionMuse* [13]. However, although *ConnectionMuse* provides the functionality to create conditional links and conditional text, which are very helpful in the creation of a multiform story, the tool does not provide the author with any visible representation of this more complex structure.

What we are interested in exploring is how the explicit representation of more complex structures affords different ways of conceptualizing interactive stories. Beyond the surface level visual user interface issues, we want to investigate how these representations impact the way that the author *thinks* about storytelling. To explore the issues surrounding the representation of more complex structures in hypertext fiction, we have created *HypeDyn*, a flexible hypertext authoring tool which allows for multiple representations of hypertext.

To identify the issues involved in authoring a multiform story in hypertext, we will first describe a famous example of a story told from multiple perspectives: *Rashomon*. We will illustrate how it would look as an interactive story created using typical hypertext authoring tools, and describe some of the things one would like to do as an author of an interactive version of such a story. In the process, we will describe how our tool, *HypeDyn*, supports such authorial decisions.

4. RASHOMON: A STORY WITH MULTIPLE POINTS-OF-VIEW

One of the most famous examples of a story told from multiple points-of-view is the Akira Kurosawa film *Rashomon*.

Rashomon, on the surface, is the story about the rape of a woman by a bandit in front of her husband, and the sub-

sequent murder of the husband. However, what the movie is really about is "relative reality" [21] - the ways in which different people can perceive the same set of events in completely different ways. The story of the rape is re-told four times: by the bandit, by the wife, by the husband (through a medium), and finally by a witness, the woodcutter. Each version contains details which make it mutually exclusive with the other versions.

The first version of the story is told by the bandit, who recounts how he encountered the woman and her husband in the forest, and decided that he wanted the woman. He confronted the couple, and managed to trick the husband into separating from the wife, at which point the bandit tied up the husband. The bandit then lured the wife into the grove where the husband was tied up, and, after a short struggle involving a dagger, he raped her. At this point, the bandit claims that he had no intention of killing the husband. As he was walking away, according the bandit, the wife insisted that, for the sake of her honour, either the bandit or her husband must die. The bandit, rising to the challenge, cut the husband free. This led to an elaborately choreographed, but quite short, duel, at the end of which the husband died. The bandit makes a point of emphasizing the honourable nature of the fight. He claims that, after the fight, the woman was gone.

The second telling of the story is narrated by the wife. She picks up the tale immediately after the rape. In her version, however, she relates how the husband was shocked and horrified at what he had just witnessed. The bandit, seeing this, ran away, laughing. When the woman looked at her husband, she saw hatred and loathing in his eyes. She cut him free, and begged him to kill her. Holding the knife, she approached him. At this point she claims that she fainted. When she recovered, she saw the dagger in her husband's chest.

Next, the (dead) husband has an opportunity to tell his tale (channelled through a medium). In his version of the story, the bandit consoled the woman and asked her to leave with him, to which she agreed. As the bandit and the woman leave, she stops him, and begs him to kill the husband. Angry, the bandit threw her aside, and told the husband that he would kill the wife if the husband wishes it. Hearing this, the wife ran off and the bandit gave chase. Hours later, the bandit returned, saying that the woman had escaped. He cut the husband loose, and left. The husband, devastated, cried in anguish and, spying the dagger, he then used the weapon to kill himself.

Finally, we hear the woodcutter's version of the story. Originally having claimed that he found the body, he now goes back and explains how he actually witnessed the murder. He claims that he came upon the trio when the husband was tied up, and the wife was crying. The woodcutter claims that the bandit begged the wife to come away with him. The woman refused, and cut the husband free. The husband said that she isn't worth fighting for, and suggested that the wife should kill herself. The bandit lost interest, and started to leave. The woman ran after him, crying. The bandit turned back. The woman then became enraged, and incited the two men to fight. A long, farsical fight followed, at the end of which the bandit, almost accidentally, killed the husband.

These mutually-exclusive versions of the same set of events very nicely capture the issues facing an author when writing a story of this form. There are clearly 4 different versions of the story. However, there are points at which the story seems to converge on pivotal events, such as the cutting loose of the husband and the death of the husband. The similarities and differences between the versions of the story are elements which the author must be able to clearly visualize.

5. AUTHORING STORIES WITH MULTIPLE POINTS-OF-VIEW

To explore the ways in which an authoring tool could support the process of writing a multiple points-of-view multiform story, we start with a node and link visualization of *Rashomon* as it might be constructed with a typical hypertext authoring tool, such as *Storyspace*.

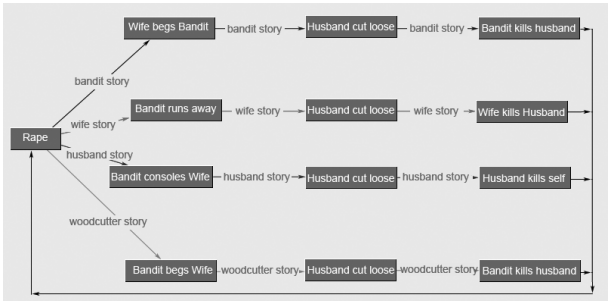

Figure 1: *Rashomon* in a typical hypertext authoring tool

The simplest way to transform *Rashomon* into a (somewhat) interactive hypertext is to create a node-link structure with 4 parallel, non-intersecting paths, each representing one of the retellings of the events following the rape. At the start, the reader is offered the option to hear one of the 4 versions of the story. The reader then goes through the nodes (stages) of this story. At the end, the reader is offered the opportunity to hear another version of the story.

Note that each path through the story consists of 3 nodes: the events leading up to the cutting loose of the husband, the cutting loose itself, and the death of the husband.

5.1 Some Limitations

This approach has limitations in terms of the representation of the alternative versions of the story. Within the multiple versions, there are many differences. This is easy to represent these differences in a traditional hypertext authoring tool, through the use of different sets of nodes and chains of links for each "path" through the story.

However, there are also points at which the same events occur, such as the cutting loose of the husband, within different paths. This cannot be seen clearly in the visualization above (see figure 1). There are also events which, although clearly similar in terms of the outcome, have significant differences in the way that they are told, such as the two different tellings of the battle in which the bandit kills the husband. There are also vast differences between events - the wife begging the bandit versus the bandit begging the wife, and the three different explanations for the death of the husband. Finally, there are differences in emphasis between similar scenes - the short, heroic battle as told by the bandit versus the long, farsical version of the battle as related by the woodcutter.

As an author, it would be useful to be able to specify these similarities and differences, and to have them represented visually within the authoring tool. This would help to emphasize the fact that the story contains several different, possibly contradictory but also occasionally overlapping, tellings of the same underlying story.

6. A TOOL TO HELP AUTHOR MULTIPLE POINTS-OF-VIEW

Now, consider the following image of the story structure.

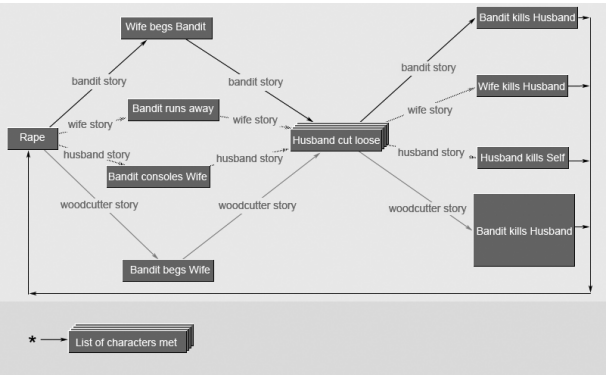

Figure 2: *Rashomon* in *HypeDyn* Authoring Tool

We have built a simple hypertext authoring tool, *HypeDyn*, to explore forms of representation in hypertext authoring environments. *HypeDyn* provides additional visual representations and mechanisms to support authorial decisions in the process of authoring a multiform story. We will now go through these in detail, with reference to our hypertext version of *Rashomon*.

6.1 Same Event, Different Paths: Conditional Links

As mentioned above, traditional hypertext authoring tools make it easy to represent sequences of different events. Each event can be represented by a node, with links connecting sequences of events in a "path" through the story. Each variant on the story can be represented by a path through the nodes.

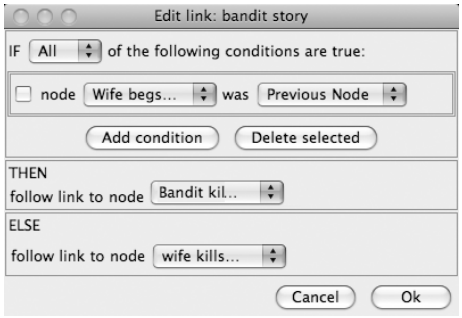

Figure 3: Creating a conditional link

However, there may be cases where the story is following separate paths, but these paths converge on a common event. In our *Rashomon* example, this can be seen at the point where the husband is cut loose. This event occurs in all 4 versions of the story. The sharing of this pivotal event between the 4 paths is not clear in our original visualization of the story (see figure 1). To emphasize the fact that the "cutting loose" event occurs in all 4 versions of the story, the author may want to actually have all the story paths use the same node (see figure 2).

At this common node, the text is identical, but the path continues on to the node corresponding to the next event in the path/story the reader came from. If the reader is reading the "bandit's story", and reaches the cutting loose of the husband, when the reader chooses to go to the "next" node, the story should continue to the next event in the bandit's version of the story. If the reader is currently reading the "wife's story", the next link should take the reader to the wife's version of what happens next, and so on for the other 2 versions of the story.

Another way of stating this is that the destination node for the "next" link shown will depend on which node was the *previous* node seen by reader. In the authoring tool, this can be implemented as an extension of the "guard fields" as seen in *Storyspace*. A conditional link, which leads the reader to the next node based on the previous node, would allow the author to do this (see figure 3). This structure creates a path through three nodes, which could be represented visually, as shown by the various line styles of the links in figure 2.

6.2 Similar Events, Different Tellings: Conditional Content Nodes

Note that in our example above, the motivation for having a shared node seems to largely be in terms of the story representation in the authoring tool. It is not as clear that this node should be *exactly* the same for each path from the reader's point of view.

This suggests that although similar events, such as the cutting loose of the husband, may actually represent the same "node" within the space of the hypertext, these events may actually need to be expressed slightly differently to the reader. In *Rashomon*, the untying of the husband is one of several pivotal events, which in the film are kept deliberately ambiguous. In the various retellings, different characters cut the husband's ropes. In several versions, the camera zooms in close, creating an *almost* identical shot. The similarity, with subtle differences, serves to emphasize the ambiguity as to which version of the story is "true". This is a key element of the narrative. It would be useful if our hypertext authoring tool could allow for a similar approach.

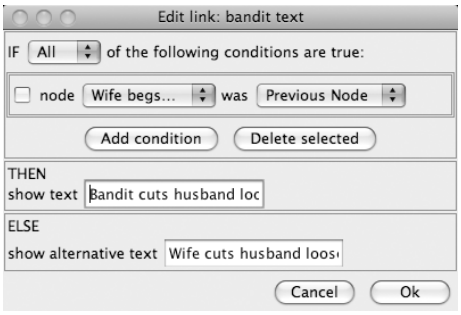

Figure 4: Creating conditional text

One way to do this would be, to allow the author to create one node, the "husband cut loose" node, but then make

the text that is shown to the reader *conditional* based on which path the reader is currently traversing. Within the common node, the author could specify several versions of the text. In a manner similar to the conditionals that can be placed on links, the text within the node could be displayed based on some expression specified by the author (see figure 4). The "procedural" nature of this node could be visually represented in the graph of the hypertext (see figure 5).

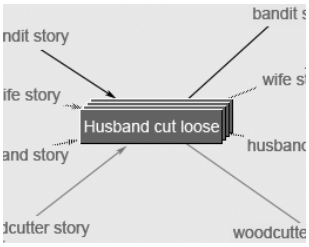

Figure 5: A node with conditional content

One issue that the notion of a "conditional content" node raises is whether this form of conditional content actually runs counter to the node/link representation of traditional hypertext. Is there an advantage to having a common node which contains multiple versions of the same event (figure 2) as opposed to having multiple nodes for the different versions of the same event (figure 1)? The former approach clearly represents the point of "convergence" within the story variants, but breaks from the notion of having each text fragment contained in a distinct node, as is the usual practice in hypertext. Generating variant versions of text based on some internal "state" of the story is a practice more common in, for example, interactive fiction [19], although it is starting to show up in recent "adaptive" hypertext systems [13, 16, 17, 10]. This suggests that works which require this form of variation may be pushing up against the boundaries of these genres.

6.3 Different Emphasis: Representing Node "Size"

Another distinction between the various paths through the story, besides the actual events within the nodes, is the amount of emphasis given to each event within the specific story path. For example, in *Rashomon*, Kurosawa spends much more time on the "duel" in the woodcutter's version of the tale, emphasizing the farsical nature of the combat between the two men, whereas in the bandit's version, the fight is much shorter. This "emphasis" may be temporal, as is the case in a film, or may depend on the amount of text devoted to the scene, as in a literary work.

It may be useful for an author of a hypertext fiction to be able to visualize the varying amount of emphasis placed on a given event. One way to do this would be to have the size of the node reflect the amount of text in the node. As shown in figure 6, the woodcutter's version of the death of the husband is much longer, as designated by the vertical size of the node, as opposed to the much shorter (in both narrative terms and visually in the authoring tool) version as told by the bandit.

Note that amount of text may not be the best indication of emphasis within a story. This is proposed as an initial heuristic, which the system can use to suggest the possible emphasis given to a node. Ideally, an author should be able

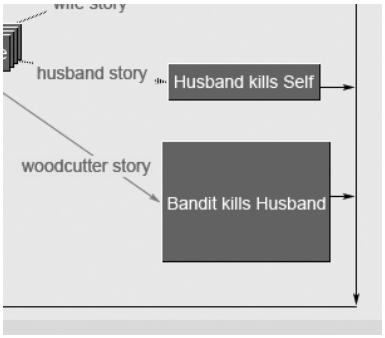

Figure 6: Showing emphasis

to change this visualization to reflect the actual emphasis given to the node within the story.

6.4 Anywhere Nodes

As the author is creating a complex multiform story such as our hypertext version of *Rashomon*, there may be information which the author would like to make available to the reader at any point in the story. For example, as *Rashomon* deals with several unreliable narrators, it might be useful to give the reader a summary of the characters in the story, and their backgrounds. This suggests the idea of an "anywhere node", which can be linked from all nodes to a node "outside" the overall story structure.

For the author, anywhere nodes appear in a separate part of the space of the hypertext, and are visually distinct from other nodes (see the "list of characters met" node in the lower portion of figure 2). Creating an anywhere node a) automatically generates an appropriate link from any node, b) displays the text that the author has written, and c) an anywhere node has a link that returns the reader to the node where the player clicked the link for the anywhere node. For the reader, they appear as links with the behavior described above. This approach can be seen as somewhat similar to the notion of "generic" links as seen in Microcosm [11], or the "tangle" structure of Card Shark [3], although *HypeDyn*'s anywhere nodes are conceived of as completely *outside* the hypertext structure, always present in every node.

6.5 Updated Anywhere Nodes

The concept of anywhere nodes introduced above allows the author to create "side" information that is always available to the reader. However, this information may depend on how much of the story the reader has seen, and which paths through the story the reader has traversed. This is particularly true in a story such as *Rashomon*, where the various paths through the story change the reader's perception of the events, and of the characters.

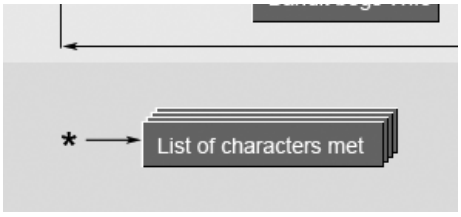

Figure 7: Updated anywhere node

To address this issue, we introduce the concept of "updated anywhere nodes." These nodes are a combination of the conditional content nodes and anywhere nodes discussed above (see figure 7). The updated anywhere node, as with the anywhere node, appears everywhere in the story, and returns the reader to the node they were at when they clicked the link to the updated anywhere node. In addition, the content of the updated anywhere node can be conditional based on *state* within the system, such as which nodes have been encountered, which node the link was clicked in, and which links have been followed.

Our initial inspiration for the updated anywhere node was the "inventory" which is often found in interactive fiction works, but a more appropriate one for the genre of the multiform story is a "list of characters met." This functionality could be used in our hypertext version of *Rashomon* to, for example, allow the reader to keep track of which characters have been seen, and which versions of the story have been heard. It could also be used to provided updated information about the various narrators, such as information about what the woodcutter has seen and done. This changing background information could be used to reflect the ongoing reformulation of the reader's theories about and understanding of the narrative.

7. CONCLUSION

As has been discussed above, traditional hypertext authoring tools provide support for a specific type of hypertext: free-form chains of nodes and links. When attempting to support other, more complex forms, such as *Rashomon*-like multiple-points-of-view stories, there are clear limitations to the traditional representations available in hypertext authoring tools. This suggests that, in order to allow authors to move beyond traditional approaches to hypertext fiction, alternative representations must be provided within the authoring tools.

Specifically, we have suggested in this paper that tools need to provide visual representations for techniques which do not directly correspond to the traditional map-based node-and-link structure seen in most hypertext authoring tools. We have suggested several extensions to the traditional map view: nodes with conditional links based on the previous link, conditional contents of nodes, and "anywhere" links which can be accessed from any node in the hypertext. These features represent a move away from predefined links and node content, and a move towards a more procedural approach to hypertext. We have implemented a prototype hypertext authoring tool, *HypeDyn*, which includes these additional visual representations and mechanisms.

Early versions of *HypeDyn* have been used for teaching interactive storytelling in an undergraduate class. We intend to have our students continue to use the current, and future, versions of our interactive storytelling tools, and refine both the tools and our understanding of the relationship between representation in the authoring tool and the ways in which authors conceptualize stories in interactive media.

Existing authoring tools for interactive stories, whether these be hypertext authoring environments, interactive fiction development languages, or game engines, tend to follow specific paradigms of interactive storytelling [18]. Additions to the interactive story author's repetiore of tools can support new ways of thinking about story structure within an interactive media environment. Providing tools for authors which allow them to think about the procedural nature of authoring in a computer-based environment will allow authors to more fully take advantage of the computational power of interactive media. Explicit representation of these more complex, procedural structures will allow authors to leverage these representations in their conceptualization of their stories, and may eventually lead to the development of new forms of interactive storytelling.

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