Limits of Rereadability in Procedural Interactive Stories

Alex Mitchell and Kevin McGee
Communications and New Media Programme
National University of Singapore
Singapore
{alexm,mckevin}@nus.edu.sg

ABSTRACT

The paper investigates the limits of what authors can vary procedurally to encourage and reward rereadability in procedural hypertext fiction. Exploring these issues raises a methodological challenge: how do we study *re*-reading in the context of stories that change? We have developed an adapted form of the Piagetan *clinical interview* to do this. Using this approach, we have determined that readers, surprisingly, do *not* want to experience endless variation when rereading interactive stories. Instead, they are looking for some form of *closure*, either in terms of "understanding the story", reaching the "best ending" for the characters in the story, or finding the "most interesting" version of the story. This has implications for the design/authoring of interactive stories and interactive art and entertainment.

Author Keywords

rereadability, procedural hypertext, interactive storytelling, narrative closure, qualitative research methodologies

ACM Classification Keywords

H.5.4 Information Interfaces and Presentation: Hypertext/ Hypermedia

General Terms

Experimentation, Human Factors

INTRODUCTION

Interactive storytelling research tends to focus on the goal of creating *variability* in interactive stories – and on handling the attendant problems of narrative coherence and consistency. This focus comes from an implicit assumption that people want to re-experience interactive stories, and that variability, both as an inherent property of the system and as an expression of user agency, will form both an encouragement and a reward for repeated experiences of the work.

But a simple example highlights some problematic issues. Many people have a strong desire to rewatch M. Night Shyamalan's film *The Sixth Sense*. Many of the reasons for this

can be undermined if the film dynamically changed in a number of ways. Similarly, it would frustrate the desire of many people to tell a friend, "you should watch *The Sixth Sense*" if they knew that the film would be significantly different for their friend. And for someone who wanted to rewatch the film *with* a friend who had not seen it, the experience would be even more frustrating.

These examples illustrate that the use of procedural change – variability – to encourage and reward rereading is complex and involves a number of narrative and technical constraints and challenges.

The remainder of this paper is structured as follows. We begin with a brief review of work that has attempted to understand and address these challenges. This is followed by a discussion of the research problem, and the method we have adopted to study these issues. We then discuss in detail our observations, and the implications of these observations for encouraging and rewarding rereading. We conclude by summarizing the implications of these observations for the limits of procedural rereadability in hypertext fiction.

RELATED WORK

Although there has been some work to discuss rereading from a literary critical perspective, there has been little work done to empirically study rereadability in either traditional or interactive stories.

There have been some empirical studies of rereading in non-interactive fiction. The area in which the most empirical work has been done is that of what is often referred to as "anomalous suspense": the fact that the reader/viewer still experiences some degree of suspense even when rereading/ rewatching a story [3, 4, 8].

In the field of hypertext fiction, rereadability has been seen as a key feature of the form [1, 2, 6]. In fact, Bernstein suggests that "hypertextuality is perceived through rereading and reflection" [2, p. 2], and "hypertext structure is perceived through *recurrence*. . . [r]ecurrence is the essence of hypertext" [2, p. 4]. It is only through repeated readings of a hypertext story that the reader can see the consequences of choices, in the variations that are a result of these choices. This notion of repetition, and the resulting juxtaposition of variations of the plot, is celebrated as a strength of hypertext. As Bernstein says, "A film must usually choose one plot or the other, but a hypertext can contrive to tell both." [2, p. 5]

Empirical studies of hypertext fiction have focused on reading, rather than rereading. Dobson and Miall have conducted a number of studies of literary hypertext [11, 13]. These studies largely involve creating a "simulated" hypertext from an existing literary short story, creating the illusion of links and choice while actually preserving the linearity and repeatability of the reading experience, for the purpose of maintaining the ability to compare reactions across subjects within the study. Taking a more naturalistic approach, Pope [17] has conducted a detailed study of readers' responses to hypertext, making use of a combination of free reading and verbal protocols, questionaires, and focus groups to access readers' responses to the works.

There has been little work to study procedural change and readers' responses to variability either in hypertext fiction or in other forms of interactive storytelling. Mitchell [14] presents the results of an initial investigation into rereadability in text-based interactive fiction, suggesting a series of motivations for rereading based on a close reading of Short et. al.'s *Alabaster*. Knickmeyer and Mateas [10] study players' responses to Mateas and Stern's interactive drama *Facade* through the use of retrospective protocol analysis. Dow et. al. [7] studied engagement and presence in several variations of *Facade* using a combination of player observation and interviews.

RESEARCH PROBLEM

As can be seen in the above review of the related work, although there has been work looking at the theoretical issues surrounding rereadability in traditional (non-interactive) stories, there has been little empirical work in this area. The majority of the empirical studies of rereading have looked specifically at the issue of "anomalous suspense". Similarly, in the area of interactive stories, although there has been discussion of the issue of rereading in hypertext fiction, there has been very little work done to study the actual experience of reading, let alone rereading, hypertext fiction or other forms of interactive stories. The few empirical studies that have looked at hypertext fiction and interactive drama have not specifically addressed either the issue of rereading, or the notion of procedural change and variability as it relates to rereading.

Since we are looking at *procedural* hypertext fiction, in which the text, and links between fragments of text, may vary procedurally between readings, to understand what techniques can be used to encourage and reward rereading, we first need to understand *what we can vary* as a reader re-encounters a text. These limitations on variability are the focus of our current study. This paper investigates ways that authors can (and cannot) use procedural variability to encourage rereading in procedural hypertext fiction.

Our initial hypothesis, based on the theoretical discussions of hypertext fiction cited above, is that readers of hypertext fiction will attempt to exhaustively follow *all* links that they find, in the pursuit of variation – and procedural changes will be rejected/accepted to the degree they violate or thwart this.

Our study systematically investigates ways in which this goal can be thwarted, and how readers respond to these attempts to disrupt rereading. This highlights some of the things authors can, and cannot, vary procedurally and still maintain rereadability.

METHOD

We want to understand what people think they are doing as they read, and reread, procedural hypertext fiction, with the goal of determining the boundaries of what authors can (and cannot) do in terms of variability to maintain rereadability. Exploring these issues raises a methodological challenge: how do we study rereading in the context of stories that *change*?

Techniques have been developed for empirically investigating literary appreciation and other aspects of reading literature [3, 5, 12]. These generally involve having subjects read a traditional, static text. Those which involve interactive stories (hypertext) are careful to ensure that the text experienced by subjects is identical [13], or focus on general issues of appreciation and reader response, without focusing specifically on rereading [17].

In contrast, we want to look at how readers respond to *procedural change* in hypertext. This is problematic, as we want to be able to look at how people are behaving in a situation where the system they are interacting with is *changing* as a result of their actions. What they encounter as they read, and reread, may not be the same between subjects, or even between readings by the *same* subject. Since the text itself is changing, we need to find something else that can be held constant.

This situation is remarkably similar to a situation that Piaget was studying in children – the cognitive processes that are at work in the face of changing problems [16]. This suggests that an adapted form of the Piagetan *clinical interview* [9] would be an appropriate methodology to use to investigate rereading in procedural hypertext fiction. The clinical interview is a flexible interview in which the researcher has subjects perform tasks, and then attempts to look for contradictions in the ways that the subjects explain their actions. Starting from some standard tasks, the researcher is free to modify the tasks in response to, and to more clearly understand, the subject's reactions. The changes to the tasks that a subject is given are often carefully chosen to create cognitive dissonance, revealing the ways in which the subject is thinking. The constant factor, which the researcher is trying to uncover, is *how the subject is solving problems.*

Our claim is that, to study rereading in the context of a dynamic, procedurally varied text, we need to understand what it is that readers *think they are doing* when they reread a story - what are their expectations, and how would these expectations possibly be violated by procedural variation. This will enable us to understand what authors can (and cannot) do when designing rereadable, procedural hypertext fiction. What is actually being held constant in this situation is *what the readers think that they are doing* as they read/reread.

In our study, we adopted an approach that is very similar to the clinical interview as described above: we started with a standard task of reading two simple hypertext stories, and then varied the stories in ways which were designed to thwart the readers' desire to follow all links. By probing the readers' reactions to these obstacles to their intentions, we were able to gain insight into the thoughts and motivations underlying the readers' explanations for their actions.

The Study Design

Using a modified version of the Piagetan clinical interview, we studied the ways in which a group of 12 readers (3 male and 9 female, ages 20-24) responded to variations of two hypertext stories, focusing on what they claimed to be doing as they read, and reread, the text, and how they responded to procedural variation of the text during rereading. The subjects were drawn from an undergraduate research methods class, and the subjects were given academic credit for participating in the study.

We constructed two simple hypertext stories using Hype-Dyn [15], representing the two most common ways in which authors structure hypertext fiction: those where links correspond to a choice of *action* within the story, and those where the links represent a choice of *perspective*. These two approaches can be seen as representing interaction at either the *story* or the *discourse* level. Both stories provided one choice between two or more links in the first node, each link leading to a different path through the story. The first story consisted of a total of three nodes in each path, including the first node, and the second story consisted of a total of two nodes in each path, including the first node.

For each story, we had subjects first read through the story once. Immediately before the subject made the choice in the first node, we asked them *what they were doing* when making the choice. Comparisons were given to, for example, buying tickets on an online movie booking website. We then asked them to read through to the end of the story. At that point, we:

1. asked for their initial reaction to the story, and

2. asked if they want to reread, and why.

To begin to understand what they *thought* they were doing as they read, and reread, the story, we then proceeded to introduce a series of hypothetical variations on the story, based on a strategy of constantly *thwarting* their possible motivations to reread the story. The intention here was to see how they react to these attempts to thwart their motivations, with an aim to foreground those motivations. This is similar to the process of identifying cognitive dissonance in a clinical interview as a means of exposing the subject's cognitive processes.

Based on our hypothesis, people should think that they are "following different paths", with the intention to "see everything". This suggests that as long as there is another unfollowed path available, they will want to take it. We wanted to block these attempts in various ways, and see how they reacted. More importantly, we wanted to see how they would explain these reactions, and whether there would be any contradictions in their explanations.

Going into the sessions, we had the following plan for thwarting readers' intentions to follow every available path:

1. make the already-followed path enticing through a "reframing" or twist ending,

2. make the not-yet-followed path seem less "interesting" by revealing what will be seen down the not-yet-seen path,

3. procedurally block whichever path has not been followed, and

4. make it so that it is impossible to follow all paths, by repeatedly adding more links, and either promising that these links will lead to better or worse variations, or by promising that revisiting previous links will always result in different text being shown.

Although we have chosen two relatively simple stories for our study, the subsequent variations contain much more than two links, in the extreme case presenting possibly limitless links to the reader. As the variations were presented to the subjects, we asked them whether they wanted to continue to follow the new links, and how these attempts to stop them from seeing everything made them feel.

We will now discuss the results of the study.

DISCUSSION

From our study, we made the following surprising observations:

1. Although readers did want to reread to follow unfollowed links, they did not do this for long. After only a few rereadings, they came to a point where they no longer felt that it was worth continuing.

2. Readers appeared to be *trying to arrive at something* – rather than simply exploring possible variations, they were goal-oriented, looking for some form of closure, whether this was in the form of the "best ending for their character", an "understanding of what the story was about", or the "most exciting/interesting version of the story".

These observations point towards limitations on what authors can vary procedurally and still maintain rereadability.

We will now discuss the results of the study in detail, and suggest implications for what authors can, and cannot, vary procedurally in interactive stories.

Following Links – But Not For Long

Our initial hypothesis was that readers will want to follow all links as long as these links have not yet been visited. At the end of each of the stories, readers were presented with a link, labelled *reread?* At this point, we asked them if they want to reread the story, and why. We observed that readers did, indeed, want to follow unfollowed links, often giving

these links priority over other, presumably more attractive but already followed links. However, after a short while, readers stopped following links.

The Desire to Follow the Unfollowed Link
For the first story, ten of the twelve subjects stated that they wanted to go back and follow the unfollowed link. The two subjects who did not want to follow the unfollowed link both stated that they didn't understand the ending of the story, and wanted to reread the same path to try to figure out what went wrong or what they had missed. For the remaining subjects, they all claimed that they wanted to follow the link that they had not followed in their first reading of the story.

For example, when subject 7 was asked if she wanted to go back and read again, she replied:

> *Subject 7*: I want to try the other option.
> *Researcher*: Oh, why do you want to choose the other option?
> *Subject 7*: Because I want to see what the ending is like.
> *Researcher*: What do you expect to see?
> *Subject 7*: I think it will be different.
> (10:50)

In the second story, all subjects said that they would indeed want to reread. One subject said that he'd actually reread the same path, as he felt the other link wasn't going to add much, and instead he wanted to see the story more clearly by rereading. All the remaining subjects wanted to read the unfollowed link.

This appears to support our hypothesis that readers will always want to follow unfollowed links. To explore this further, we set out to attempt to thwart the desire to follow unfollowed links by making use of a number of different techniques.

Reframing to Thwart the Desire to Follow Unfollowed Links
The first technique used in the story was an attempt to create a *reframing* at the end of the text. Using *The Sixth Sense* as a model, we structured the story such that the ending undermines the reader's initial reading of the story, and changes the way that the reader perceives, and feels about, the main character in the story. The first page of the story presents a scenario where the main character, at home alone, hears kidnappers breaking into the house. The choice, of whether the character should make a break for the front door or stay quiet and hide in the kitchen, leads to a second page, where in both cases he is caught by the kidnappers, although he stabs one of them in the process.

The third page reverses the reader's understanding, revealing that the police who are responding to the disturbance are concerned about a situation where a family is trying to subdue their son, who has apparently gone crazy. This reveals the kidnappers to actually be the main character's family, whom he imagines to be strangers breaking into the house. Note that both paths which the reader could take ultimately lead back to the same third page.

We intended this reframing to act as an encouragement for the reader to go back and reread the *same* passage that they had just read, as they may want to see the text a second time now that they know something they didn't originally know.

Despite the presence of the reframing at the end of the story, readers still insisted that they wanted to go back to *follow the unfollowed link*.

For example, when asked why she didn't want to re-read the first path, subject 6 said:

> *Subject 6*: If I choose the first scenario, I know what's going to happen. If I choose the first scenario, nothing's going to happen. And now for me as, like, I'll be looking at it, if I read again I want to see more stuff happening.
> (08:16)

Here, subject 6 clearly wants to see something she hasn't seen before.

Interestingly, although subject 7 had originally said that she wanted to follow the unfollowed link, when asked again later in the study, she said she would want to reread:

> *Subject 7*: The part where he grabbed the knife.
> *Researcher*: So how would that be different?
> *Subject 7*: Because a usual boy wouldn't, you know, grab the knife to murder someone.
> *Researcher*: But you didn't find it strange the first time.
> *Subject 7*: No [laughs]
> *Researcher*: Why is that?
> *Subject 7*: Um, because I thought its like self-defense, its something that's close to him and he grabbed it.
> *Researcher*: And now?
> *Subject 7*: Now I think, umm [pauses] he just wants to kill someone.
> *Researcher*: Hmm, so you think the reason for grabbing the knife is very different?
> *Subject 7*: Yeah.
> *Researcher*: Would you want to read that part again?
> *Subject 7*: Yeah! [laughs]
> *Researcher*: Ok, but previously you said that you would go back and do the different one, right?
> *Subject 7*: [nods]
> *Researcher*: So now you want to go back and read the same one again? or are you thinking that maybe he grabbed the knife in the other one as well?
> *Subject 7*: I would read through the original one that I clicked first, make sure I didn't miss out anything.
> (23:45)

Note that at this point in the study, as will be described below, the unfollowed link has been procedurally blocked, so that it *cannot* be clicked. The subject has apparently changed her mind, and now claims that she'd rather follow the previously followed, and currently unblocked, link. What is interesting here is that her justification for this preference is not that the previously followed link is unblocked, and is

therefore the only available choice. Rather, she says that the unblocked, previously followed link is the more interesting choice, which contradicts her earlier response.

The researcher wanted to probe into this contradiction, to find out what the reader was thinking – why was she now saying she wanted to reread the same link? Did she still want to follow the unfollowed (and now blocked) link, or was the reframing really more enticing? To do this, he presented her with a slightly different dilemma:

> *Researcher*: So if you had a choice, if it was like this [resets system so that both links in first node are unblocked] if it wasn't blocked out when you came back, which one do you think is more interesting to do? What you just said, which is go back and read the same one again and think about the knife for example, or what about finding out what happens if he makes a break for the door?
> *Subject 7*: You mean after I read this?
> *Researcher*: Yes, so imagine you read through and came back and it wasn't blocked, so you could click on either link.
> *Subject 7*: I would click this [gestures to unfollowed link].
> *Researcher*: Even though you just said that its interesting to see that bit about the knife again and think about it?
> *Subject 7*: Yeah but I wanna know the other ending before I go back and look at the first one again.
> (25:34)

It appears that the reframing is indeed encouraging the reader to go back and reread the first link. However, when probed, subject 7 still felt that, if given the choice, following the unfollowed link was more interesting, *after* which she wanted to go back and follow the first link again.

Note that the type of dissonance present in this situation, where the subject is making a decision which appears to be in conflict with an earlier decision, is exactly the sort of occurance which forms the core of the clinical interview method. At this point, the subject's attempts to reconcile the contradiction between the current and the previous decision can reveal the underlying reasons for the subject's actions.

The use of a reframing at the end of the story was an attempt to thwart the reader's desire to follow all unfollowed links by providing a strong reason for the reader to want to go back and reread *the same version* of the story. However, subjects still wanted to follow unfollowed links, despite the change in understanding of the other path, and in the face of a desire to also reread the original path, as can be seen in the difficulty subject 7 had making a decision. This suggests that our hypothesis that following unfollowed links is the main reason for rereading still holds.

Thwarting by Revealing Outcome
A second way that we attempted to thwart the reader's desire to visit all unfollowed links was to reveal the outcome of

unfollowed links *before* the link was followed. Note that this suggestion was made before the "reread?" link was clicked.

The idea behind this variation was to see how subjects responded to the possibility that they *already know* what they will see when presented with unfollowed links. If our hypothesis holds, then readers will *still* insist on following these links. In this case, we were interested in hearing their rationalization for this behaviour – if they already know the outcome, and their reason for saying they wanted to follow the unfollowed link was to find out "what happens" as a result of following that link, then why still insist on following the link, particularly in the face of the reframing, which should make the already-followed link at least somewhat tempting.

All but two of the readers claimed that they would still want to follow the unfollowed link, despite knowing what the path contained. When questioned, subjects insisted that they "wanted to see for themselves" what the path contained. They felt that it was the *details* of what happened that would be important, and that being told, in what they assumed would be a summary, was not enough.

One subject in particular stressed that the exact wording of the story might reveal information that would help her understand the story. According to subject 11:

> *Subject 11*: The way text is being written, the words they use, the description is quite important.
> (16:16)

When it was suggested that the unfollowed link would be *much less satisfying* than the original link, subjects still wanted to follow the link, again stating that they would want to "see for themselves" if it was better or worse. Interestingly, for subject 2, who was one of the two subjects who said that they would not follow the link if the outcome was revealed, he changed his mind when it was suggested that the unfollowed link would be less satisfying. He clarified that this was because he now assumed that the ending would be different – for him, it was whether or not the *ending* was the same that mattered:

> *Subject 2*: For me I'm more interested in like, the ending, the end result, like what happpens. Even though there's some variation in the process, if the end result is like the same, then I'm like, I don't really find it interesting any more since its going to be the same
> *Researcher*: What if the end result is definitely uninteresting?
> *Subject 2*: I guess then I'd follow it, since the end result is different, even though I find it boring its different.
> (25:46)

This suggests that readers do indeed feel the need to follow all links, not merely to have actually clicked on all the links, but to have actually traversed all the possible paths, and gained access to all possible information.

*Thwarting by **Literally** Blocking Choices*

The above attempts to thwart the reader's desire to follow all unfollowed links did not literally prevent the reader from following the link – instead, they attempted to either increase the reader's interest in following the previously followed link (reframing) or to make the unfollowed link less interesting (by revealing its contents). A more literal, and more clearly procedural, approach would be to actually *block* or disable the unfollowed link. In our stories, when the subject first makes a choice as to which path to follow, the system remembers which link was taken. Then, when the subject clicks on the "reread?" link to go back to the first page, the system disables whichever link was *not* previously followed.

At this point, we asked the subject how they felt. We had varying reactions, from mild frustration (subject 6) to "this is shitty!" (subject 10). All subjects except for the two who claimed that they wanted to reread the first link expressed disappointment that they were unable to follow the link that they had not yet seen. When then asked if they would instead go back to reread the first link, they still felt that this was not of interest, as they had "seen it before". Subjects seemed to have an expectation that they would be able to follow the other path, and were disappointed that this option had been removed.

For example, according to subject 2:

> *Subject 2*: So its like, I'm rereading it because I already, I don't see a need to actually correct my image because I already know this is describing kidnappers that are actually trying to help the boy because he's mentally unstable, so I'm actually rereading to see what the second option is all about, so now since the second option is actually blocked out, so I'm now like...
> *Researcher*: Would you try to follow the first link again?
> *Subject 2*: I would say on my very first thought that there's no point reading it any more.
> (16:55)

We next suggested that a *new* link would appear below the two existing links when the reader clicked on "reread?" The intention here was to see how they react to the new link, and to see if this makes up for the frustration of being unable to follow the second link. We wondered whether they would still want to go back to the second link, or would it be enough to follow *any* new link.

Subjects were somewhat less annoyed, claiming that they would, indeed, want to follow this new link, but that they were still disappointed that they couldn't follow the second link. Most said that this was because they had that second link in mind as they were reading the story, and had been planning on going back and trying it once they reached the end.

As subject 2 explained:

> *Subject 2*: At least I have some other thing to try other than what I've already chosen, but they're forcing me, I

don't have the same choice as before.
(18:32)

As a subtle variation on this technique, we suggested that the new link *replace*, rather than appear in addition to, the unfollowed link. This generally resulted in the same reaction. However, two subjects did say that this might not feel so bad, as they may not have clearly remembered the details of the unfollowed link. As subject 2 said:

> *Subject 2*: I think it will reduce the affect, because basically perhaps I won't remember the first choice, its like I'm not sure if that's the same as the first one, at least its different than trying to stay as quiet as possible.
> (21:07)

When Will They Stop Following Links?

Our initial hypothesis was that people will want to reread a hypertext *as long as there are unfollowed links*. When rereading, our hypothesis was that people are aiming for completeness, to make sure that they have seen everything and followed every link. This implies that as long as there is an unfollowed link, the reader will follow it.

The subjects' reactions to the thwarting of their attempts to follow an unfollowed link suggest that readers do indeed want to follow all unfollowed links. Even when presented with a strong reason for reading the previously followed link, with information on the contents of the unfollowed link, and when literally blocked from following the unfollowed link, they *still* wanted to follow the unfollowed link.

To investigate this further, we introduced a variation intended to make it *impossible to successfully follow all the links in the story*, by dynamically adding new links *every time* the story is reread. This means that there is no way that the reader could ever finish following new links.

We then asked subjects whether they would be interested in following these links. With the exception of the one subject who said he had no interest in following any new links, all the subjects said that yes, they would like to follow the new links, for the same reasons that they gave in the initial presentation of a second link. When we probed further, reminding the subject that each time they followed a link, another would appear, they admitted that they would "eventually" give up. When pushed as to when they would stop, they tended to give an arbitrary number, such as 5.

For example, according to Subject 4:

> *Subject 4*: If there are like 3, 5 maximum, if it goes any bigger than 5, then I'd just give up on the story.
> (18:12)

Asked to clarify how they would make this decision to stop, most subjects mentioned some variation of noticing repetition or "not getting anything new" from the links. Subject 4's explanation was as follows:

Subject 4: Yes, I would go on until I get bored. If its repeating the same scenario again in different words I might get bored.
(23:01)

The above observations show that, as we had originally hypothesized, readers do indeed want to follow unfollowed links, and do so even in the face of other techniques, such as reframing, which should make the already-followed link more enticing. Readers are frustrated when their desire to follow the unfollowed links is thwarted, for example by procedurally blocking the unfollowed link. However, as seen above, readers report that they *would* stop reading after a few iterations. This is quite different from what we originally believed.

We will now discuss our observations as to what readers claim that they are doing as they read and as they reread, and how this connects to their reasons for stopping.

Rereading to Arrive At Something

Readers tended to stop rereading, even when there were unfollowed links, which did not match our initial hypothesis. When pushed for further explanations, and coupled with what readers said they were doing as they clicked on links, it became clear that readers were *rereading to arrive at something* – a "good ending" for the main character, a clear understanding of the story, or some explanation as to "what really happened". They tended to stop either when they felt they had reached this goal, or when that goal came to seem unattainable. We will now discuss the observations that led to this conclusion.

What Do People Think They're Doing As They Are Reading?

To begin with, we need to understand what readers felt they were doing as they read the story and made choices as to which link to follow.

In the first node of both stories, readers were initially presented with two choices. As the subject was about to click on one of the links, we asked the subject how they would describe what they were about to do. In the story that presents a choice of action, readers claimed to be either choosing the "safest" option for the character, choosing the option which they felt would be "most interesting" in terms of creating an entertaining story, or choosing the option most likely to reveal more information which will help the reader understand what is happening in the story.

For example, according to Subject 4:

Subject 4: I was trying to guess what would happen, I'm trying to find the perfect ending.
Researcher: So how would you know when it's the perfect ending?
Subject 4: It just kind of feels right, its more subjective, something rational, there's a cause to it, I hate when it so abruptly ends, there's no closure to the whole thing.
(14:45)

In this case, the reader was trying to get some form of "good" ending and a sense of closure.

For Subject 3, the focus was more on helping the character to survive:

Subject 3: I chose to remain quiet, I think its the smarter way, because they're armed [pause] it's the smarter way for the character.
(12:26)

The second story involved a choice of perspective. The first page of the story presents a scenario where two characters, a man and a woman, are having dinner. The woman pays, and outside the restaurant the couple argue, and then drive home in silence. The reader is initially given a choice to hear what happened according to either the man or the woman.

In this story, readers described what they were doing as either choosing the person they most "identified with", choosing the person whose perspective they felt would be "most interesting" based on the context, or choosing the person they felt would add the most information to their understanding of the story.

For example, Subject 12 chose to follow the link describing the man's perspective, because she felt it would give her more information to help her understand the story:

Subject 12: I saw the woman she's like paying with her credit card, and there's nothing about the guy, so yeah it makes me want to know like, maybe the fight started because he has some, uh, ideas about something and I want to find out.
(12:30)

Readers had many explanations for making a choice between the two links in the first node of the story. However, all the explanations appear to be describing a careful choice which, rather than simply involving an attempt to "see everything", appears to be working towards a specific goal or end-point. This goal-oriented behaviour can also be seen in the subjects' descriptions of what they thought they were doing as they *reread* the stories.

At the point when the reader has already clicked on the "reread?" link, we probed them again as to what they were doing when clicking on a link, given that previously they had explained that they were either making a choice that seemed best for the main character, looking for the "best" story in terms of the dramatic impact, or trying to find out as much as possible about the story.

Some subjects continued to claim the same motivation. Others, however, responded differently. For example, one subject, who had initially claimed to be thinking about the choice from the point of view of the main character, now said he was looking for a dramatically interesting story. He claimed that it was only during that first choice that he was concerned about the fate of the character – after that, his focus shifted to exploring all the possibilities for a satisfying story, where

satisfaction was defined in terms of the storytelling rather than the outcome for the character. Whether their explanation changed or remained consistent with their original motivation, all subjects described a goal that they were working towards.

Reasons For Stopping

In an attempt to clarify this situation, where subjects seem willing to follow unfollowed links, but at some point they stop, we introduced several slight variations to our procedurally added links. Our intention was to figure out if there was some "stopping condition" that the subjects were using, and if so, what this condition might be.

For the first variation, we suggested that subsequent links would be "better" than the previous link. Note that we didn't define what we meant by "better", leaving this up to the subject to interpret. All but one subject said that they would continue to follow links as long as the resulting content was "better", but that they would still stop after several clicks. Most claimed that, although we insisted the story would "get better", they felt this was not possible, and that at some point it would "become predictable" or "start repeating". Even if it could somehow get "better", they felt that this would become almost insignificant.

When probed as to what they thought we meant when we said the story was "getting better", subjects had varying responses. These responses corresponded to their explanation as to why they wanted to reread.

In the "choose action" story, except for two subjects, all said they were looking for a *more interesting story* in terms of the dramatic impact and events that happened. Of the other two subjects, one didn't want to reread, and the other continued to look for the best choice for the character. Some mentioned that they were also looking for what "really" happened, referring back to the reframing and the revelation that the man was not actually being attacked by kidnappers.

In the "choose perspective" story, subjects said they were looking for a clearer understanding of "what happened", seeing each link as providing new perspectives on the story. However, they felt that simply giving "new" information was not enough, and that they would judge whether a link was worth following by how relevant they felt the new information would be to their understanding of the story. Some felt that providing new information that further reframed the story, such as suggestions of an affair between the couple, might increase their interest, but as long as it didn't "go too far" from the original story. Similarly, they tended to judge whether a link was worth following by "how close" the new pespective was to the original scenario: the waiter's perspective was usually important (although one subject said they already had his point of view as presented in the first page), whereas the couple at the next table were not so important, and somebody passing by outside was largely unimportant.

For example, according to subject 11, if offered the waiter's point of view:

Subject 11: Yes I'd like to see it, but it won't give me the true reflection of the main characters, its like a third party view.
(17:46)

However, she still might click on it, as:

Subject 11: At least I have an option to listen to one more person's perspective [pause] like it forms part of the picture, like a jigsaw.
(18:36)

For subject 11, reading the story was like putting together a puzzle, and new links were followed as long as they seemed to contribute to that puzzle.

In all these cases, it seems that the subjects feel they will reach a point where it "can't get any better", although they resisted the suggestion that they had actually seen the "best" version. The belief that it will become repetitive suggests that they feel that although there is the *possibility* of a better version, it wouldn't be better in any significant way.

For subject 8, reading the "choose perspective" story was all about getting to know the characters clearly. When told that new links would add complications to the story, she said:

Subject 8: It might change how I feel towards the man, maybe the second layer that I want to know about the guy is what the character's like, so I hear from another person then I know what the character is about [pause] it gives more room for me to think about.
Researcher: What if subsequent links continue to add depth to the character?
Subject 8: I think I would, would stop when I hear enough, like if I'm more interested to know about the man's character, if I'm looking for one lead in the story then I would follow that.
Researcher: When is it enough?
Subject 8: Like you know the man's character then ok, so he's a philanderous person, then enough to the point that I can link back to the point that I know why he doesn't want to pay, he doesn't love his wife already, then that's enough.
(23:10)

Similarly, we suggested a variation where each subsequent link is *worse* (by the subject's own measure of "better") than the previous. In this case, subjects said they would try "2 or 3" links, to see if there were any better links, and then stop.

This series of variations suggests a change to our original hypothesis. We had originally claimed that readers would want to follow *all* unfollowed links. Although our attempt to thwart this through reframing and revealing the contents of the link did not succeed, when there were limitless unfollowed links, it became clear that subjects were *looking for the "best" link*, limited by their concept of whether the links could actually improve beyond a certain point. This was the case in both the "choose action" and the "choose perspective" stories.

IMPLICATIONS: LIMITS ON PROCEDURAL CHANGE
The observations discussed above suggest certain limits on what authors can do in terms of procedural change and variation, if the author wants to maintain rereadability. We will now summarize the findings.

Our initial hypothesis was that readers of procedural hypertext fiction would continue to follow unfollowed links, in an attempt to explore all variations. When rereading, as we had expected, readers seemed to prioritize trying to follow unfollowed links over rereading followed links. Somewhat surprisingly, this desire to follow new links remained even in the face of reframing. However, what was more interesting, considering that most discussion of hypertext suggests that readers will continue to try to follow unfollowed links, was our discovery that readers claim that they would stop following new links quite soon, after 5-6 links, even if the new links are presented as more interesting than previously read links. It appears that readers feel that, after a certain point, it is highly unlikely that new links will continue to be more interesting, even if a "best" version has not yet been found.

We also saw that readers seemed to have been trying to arrive at a particular conclusion, based on what they felt that they were doing as they made choices in the story. Readers who were convinced that they would not get any further towards this goal, either because the links seemed not to be getting "better", or because they felt that it was not possible for the links to continue to improve, felt that they would stop rereading.

This behaviour is quite different from the notion of the reader who is willing to reread an interactive story to seek out variation for its own sake, or simply to compare the new reading with previous readings. In non-interactive stories, readers tend to be looking for closure, as this is a natural part of narrative. People also tend to be fairly goal-directed. With these two facts in mind, it isn't surprising that readers tend to be goal-directed and look for closure when reading, and rereading, procedural interactive stories. This desire for closure is consistent with what Pope observed in his studies of readers of several existing hypertext fictions [17].

These findings imply that, before trying to solve the problem of procedural variation in interactive stories, researchers first need to determine *what it is that readers really want* from procedural interactive stories. Although it can be argued that readers don't know what they want, and authors innovate all the time, this does not invalidate the need to understand how people actually respond to the new forms of storytelling that are being invented. Without some attention being paid to reader response, research into interactive storytelling risks focusing too much on technological solutions to problems that may not connect with the reader's actual experience of these works.

CONCLUSION
In this paper, we have discussed our investigation, through a series of clinical interviews, of the limitations which authors face when creating procedural variations in hypertext fiction.

From this study, we derive insight into what can, and cannot, be varied procedurally to encourage rereading of procedural hypertext fiction. Surprisingly, we found that 1) although readers did want to read variations on either action or perspective, they *did not want to do this for very long*, and 2) readers appeared to be *trying to arrive at something* – a sense of "what actually happened", the "best ending" for the characters in the story, or a clear understanding of the narrative.

The desire for closure is not, on its own, surprising. What is surprising is that even in the case of narratives deliberately designed to foster and support multiple perspectives (or other authorial attempts to support something other than narrative closure), readers *still* have the goal of achieving narrative closure (which can take many forms), and that they stop reading when they feel they have reached this goal.

This is very different from the commonly held belief that readers of interactive stories are looking for continued variation, a belief which drives much of the technical research in the interactive storytelling community. The problem of procedurally generating variation on repeated experiences of a work, and maintaining consistency and coherence in the face of this variation, is usually seen as a way to solve the problem of the "explosion of branches" that results from manually creating variation. Our findings suggest that this may not, in fact, be the problem that needs to be addressed. Rather, work is first needed to understand *what readers are looking for* in repeated readings of a work. Only once this is understood can we begin to address the creative and technical challenges involved in satisfying what readers want from interactive stories.

This paper makes three significant contributions. First, we have presented a methodology, based on a modified version of the Piagetan clinical interview, for studying *rereading* in the context of interactive stories that change: namely, to focus on the *goals of rereading* (rather than, say, aspects of the story that remain constant). Second, by concentrating on *what people are doing* when they reread, we have also identified an important aspect of rereading in hypertext fiction: rather than simply exploring variations, readers are trying to reach the "best story" – even when the variant versions/stories are clearly framed as "alternate" versions. Finally, based on the evidence that people are searching for the "best version", we have identified a number of surprising limitations on the kinds of procedural change that re-readers will accept. For procedural stories that involve choosing from a set of options, whether these options are presented as links in a hypertext, text to be entered via a parser, or other ways of selecting from a range of possibilities, readers expect a sense of progression towards a goal. Variations which thwart movement towards this goal, such as the generation of seemingly unrelated stories or stories which contradict previous versions, will not be accepted. This places severe limitations on the types of variation which can be created procedurally.

It should be noted that we are deliberately taking a qualitative approach to our research, as the goal of this research

is to understand what people care about, and what they are doing, as they reread procedural hypertext fiction. Quantitative studies will be important as a follow up to this study to provide support for generalizing these findings.

Beyond their implications to the creation of procedural interactive stories, the contributions discussed above are relevant to the wider CHI community. For example, when searching for a particular topic in an Internet search engine, users often type in a search string, and then follow some of the links. When returning to the original search, it is possible that the results may have changed. It isn't clear how a user will react to this – will they expect to be able to follow the "next" link? What if that link is no longer the same as it was on the previous search? What if the user sends the search results to a friend, and asks the friend to look at the second link? Similarly, if a user is browsing an e-commerce system which presents customized results to the user based on both the user's previous browsing and purchasing behaviour, and the behaviour of other users of the same site, there is no guarantee that what is available on, for example, a "recommendation" page, will be the same between visits. There is even less guarantee that a user will be able to make reference to what they've seen on the web page when discussing the site with a friend.

These implications can also be extended to various forms of art and entertainment, where there are attempts to procedurally generate different kinds of content or other aspects of the artwork. If subsequent experiences of an artwork, either by the same person or by a friend, result in the generation of variant versions, how can the participants engage in any form of meaningful discussion about the resulting aesthetic experience? Even if this lack of a stable reference point *is* the intention of the artist, it is worth considering the impact of procedural variation on the participants' experience.

The issue of how people react to these types of dynamic systems, and how these systems can be studied, is something that has not clearly been addressed, and is very similar to the issues discussed in this paper. Based on our observations of how people respond to procedural change in hypertext fiction, it is clear that people have certain expectations of how these systems will behave, expectations that may not match with the assumptions that researchers and developers have made. As these types of dynamic, adaptive systems are becoming more widespread, it is important that we know both how to study such systems, and how people respond to them.

ACKNOWLEDGMENTS

REFERENCES
1. M. Bernstein. Patterns of hypertext. In *Proc. Hypertext '98*, pages 21–29, New York, NY, USA, 1998. ACM.

2. M. Bernstein. On hypertext narrative. In *Proc. Hypertext 2009*, New York, NY, USA, 2009. ACM.

3. W. F. Brewer. The nature of narrative suspense and the problem of rereading. In P. Vorderer, H. J. Wulff, and M. Friedrichsen, editors, *Suspense: conceptualizations, theoretical analyses, and empirical explorations*, pages 107–126. Routledge, 1996.

4. N. Carroll. The paradox of suspense. In P. Vorderer, H. J. Wulff, and M. Friedrichsen, editors, *Suspense: conceptualizations, theoretical analyses, and empirical explorations*, pages 71–91. Routledge, 1996.

5. P. Dixon, M. Bortolussi, L. C. Twilley, and A. Leung. Literary processing and interpretation: Towards empirical foundations. *Poetics*, 22(1-2):5 – 33, 1993.

6. J. Y. Douglas. *The End of Books - or Books Without End? Reading Interactive Narratives*. University of Michigan Press, 2001.

7. S. Dow, M. Mehta, E. Harmon, B. MacIntyre, and M. Mateas. Presence and engagement in an interactive drama. In *Proc. CHI 2007*, pages 1475–1484, , New York, NY, USA, 2007. ACM.

8. R. J. Gerrig. Suspense in the absence of uncertainty. *Journal of Memory and Language*, 28(6):633 – 648, 1989.

9. H. P. Ginsburg. *Entering the Child's Mind: The Clinical Interview in Psychological Research and Practice*. Cambridge University Press, 1997.

10. R. L. Knickmeyer and M. Mateas. Preliminary evaluation of the interactive drama Facade. In *CHI '05 extended abstracts*, pages 1549–1552, New York, NY, USA, 2005. ACM.

11. R. Luce-Kapler and T. Dobson. In search of a story: Reading and writing e-literature. *Reading Online*, 8(6), May/June 2005.

12. D. S. Miall. Readers' responses to narrative: Evaluating, relating, anticipating. *Poetics*, 19(4):323 – 339, 1990.

13. D. S. Miall and T. Dobson. Reading hypertext and the experience of literature. *Journal of Digital Information*, 2(1), 2001.

14. A. Mitchell. Motivations for rereading in interactive stories: A preliminary investigation. In R. Aylett, M. Lim, S. Louchart, P. Petta, and M. Riedl, editors, *Proc. ICIDS 2010*, pages 232–235. Springer Berlin / Heidelberg, 2010.

15. A. Mitchell and K. McGee. Designing hypertext tools to facilitate authoring multiple points-of-view stories. In *Proc. Hypertext 2009*, pages 309–316, New York, NY, USA, 2009. ACM.

16. J. Piaget. *The child's conception of the world*. Rowman & Littlefield Pub Inc, 2007.

17. J. Pope. Where Do We Go From Here? Readers' Responses to Interactive Fiction: Narrative Structures, Reading Pleasure and the Impact of Interface Design. *Convergence*, 16(1):75–94, 2010.