

# Design-Driven Narrative: Using Stories to Prototype and Build Immersive Design Worlds

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## ABSTRACT

This paper examines the role of narrative in the process of interactive experience design, focusing on the potential uses of narrative in prototyping and iteration efforts to uncover deeper and more meaningful responses from users by engaging them in the co-creation of narratives of use around the design. We created a series of narrative fictions with embedded design concepts, and built low-fi prototype artifacts for directed storytelling sessions with twelve participants. We conclude with a discussion of findings regarding the opportunities to more effectively use narrative techniques and immersive storytelling to create valuable experiences between designers and users.

## Author Keywords

Narrative-driven design; design evaluation; reader-response theory; prototyping; scenario building;

## ACM Classification Keywords

H.5.2. User Interfaces: Theory and Methods; Prototyping; User-Centered Design;

## General Terms

Design, Human Factors, Theory

## INTRODUCTION

Evaluating near-future design artifacts in a diegetic (designs embedded within a story) setting offers opportunities for designers to explore deeper levels of cognitive engagement with prototypes, but several issues exist. We believe that effectively prototyping diegetic design concepts requires equal attention on both the design and the story that supports the design in order to provoke deep responses to the design work and the alternative future it implies. Designers often test design concepts for their usefulness, usability, and desirability using storyboards and scenarios. When prototyping diegetic designs, these qualities are equally important as the coherence, fidelity, narratives, and plot in the story that supports the design. Dourish and Bell have observed the degree to which fictional visions of the future shape our

collective cultural understandings of “the relationship between science and progress and between people and technology,” and the profound impact this can have on the design of interface systems [9]. Indeed, some of the most advanced interfaces that we know have come from science fiction and the cinema, including, for example, the gestural interface depicted in “Minority Report” that was developed by Oblong Industries prior to the release of the film [18]. By embedding new technologies within a story, and within a specific scene, audiences can be presented with a deeper opportunity for engagement than would otherwise be possible through a procedural overview of the interface in non-cinematic settings. Indeed, storytelling is a critical design tool in human-computer interaction to help educate stakeholder audiences and gain funding for near-future design concepts, bridging the gap between possible alternative futures and the flaws of the present [33, 11].

In Human-Computer Interaction Design, narrative is frequently discussed as a tool for synthesizing user research (*e.g.* scenarios [2] and personas [31]) and explaining design decisions and plans to internal stakeholders or engineers (*e.g.* use cases). Narrative, scenarios, and personas have been championed since the early 1990s as valued design tools in coalescing meaning and understanding amongst design teams and to stakeholders [6]. In the area of critical design, Gaver has used narrative and scenarios to articulate cultural communication in potential futures [15] as Dunne and Raby have done with alternative realities [12]. Narratives have also been explored in the context of engineering research [4], which has been highly influential with regard to the use of scenarios in HCI and design. Recently, designers and psychologists have used ambiguous film and character narratives as tools to engage users and generate insights during early stage concept development [3]. However, narrative has only recently begun to be rigorously explored as a tool for interaction designers to provoke and engage users in prototyping sessions [16], largely because the narrative mechanics of effective storytelling are exhaustive. Designers often ask users to create their own narratives as part of research activities, such as diary studies [1], but the practice of putting narratives in front of users as an integral part of the design is a rich and largely untapped space.

This paper presents narrative-driven design as the practice of embedding concepts within narrative structures that are as integral to the design as the design itself, and using

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narrative-driven design to provoke responses when evaluating prototypes. In this regard, Nielsen's work on users, characters, and the portrayal of characters in scenarios [29] has been highly influential in our understanding of how users relate to scenarios and personas within them. We have also been influenced by Wright and McCarthy's work at the intersection of psychology and narrative, and its implications for designers. They write, for example, that "When someone talks about a personal experience they have had, they tend not to be solely concerned with telling people what they did. Rather their story seeks to talk about why they did it, what it felt like, what it meant to them, its value in their lives and what commitments they have made as a consequence." [35]

In this work, our aim is to leverage research surrounding storytelling, meaning making, and cognitive psychology to suggest an alternative method for prototyping and iterating [33, 9]. By creating a series of narrative fictions with embedded design concepts and testing them on users, we examined how experience-centered narratives might be more explicitly used throughout the design process, from ideation to prototyping to evaluative stages. The aim of this work is not to suggest alterations to existing design processes, but rather to present a new tool for designers to consider, and discuss the potential variations that designers can use to evoke a variety of responses when prototyping interactive experiences. By rooting design concepts within a sensory story world, we believe designers can help their audience develop greater levels of engagement with both the concept and the story and connect more meaningfully to experiences in their past or present. In light of recent changes to the publishing industry, and the rise of interactive narrative, this paper offers tools and concepts of value to digital storytellers as well.

As a basis for investigating these issues we turn to reader-response criticism theory [28] to understand how people interpret designed multisensory narratives, and the points at which the coherence and/or fidelity of either the story or design break down, leading them to co-create elements of one or both through a 'mis-reading' of the intended message. Reader-response criticism focuses on the reader's experience with a piece of literature, rather than focusing on the author, or the work itself. Whether intended or not, the reader's response to the work creates a new meaning that the author is powerless to control or affect [21]. This theory is as interested in mis-readings and interpretations that deviate from the intended message as it is in the relationships between the reader and their environment. Yet while reader response theory is often used in rhetoric and media constructions, it is not frequently applied to the practice of design. More recent studies [20] in reader response theory have focused on multisensory and multimodal texts such as graphic novels, illustrating the added dynamism that occurs when multiple senses are engaged. In this regard, reader-response theory can be used to codify the effectiveness or failure of ambiguous design experiences.

A parallel to reader-response theory for design may be Don Norman's work on affordances, and a study of how experience influences our potential misuses of designed affordances [30]. It is important to understand why and how affordances can be misinterpreted. In this regard Gaver *et al.* have noted the potential for ambiguity as a resource for design, since while ambiguous design experiences can range from confusing, frustrating, or meaningless at worst, they can also inspire individuals, raise unexpected issues and opportunities, and lead people to consider new beliefs and values [14]. Indeed, externalizing bad ideas can help to clarify good ideas [10].

In recent years a variety of methods for prototyping and evaluating HCI interfaces have become increasingly common in design research, typically involving directed storytelling sessions centered on design-oriented scenarios for the purpose of usability testing, needs-validation (*e.g.* speed dating [7]), and other forms of evaluation [19]. Often these activities include the use of interactive prototypes, low-fidelity paper prototypes, or other varieties of tangible concept prototypes [1]. In each of these cases, design concepts are framed and articulated as a means to assess usability and desirability issues as part of a simulated and controlled experience. While much design literature discusses these methodologies with respect to the evaluation and improvement of designs, less attention has been focused on the interplay between the design and the narrative that supports it. This, in short, is the goal of our paper.

#### **Design-Driven Narrative**

Design and narrative have always been deeply intertwined, but the recent emergence of distributed and cross-platform interactive systems in entertainment and marketing fields has created new fundamental links between design and narrative.

As consumption patterns and social media have altered the way narrative content is created and consumed across platforms, HCI designers are able to make use of a new set of narrative tools for evaluating their designs in a way that matches their consumption of design and narratives in our contemporary techno-society [23]. Embedding a design within an immersive and provocative narrative provides new opportunities for gaining real-world responses to the design. However, valuable responses will be predicated upon the designer having an understanding of the basic fundamentals of good fiction: plot, characters, arcs, and resolution. In addition, designers must learn to think like storytellers if they are to reap the real rewards of diegetic design prototyping [5]. Consider, for example, a desirable design embedded in a flawed story that fails to engage the reader. Such a design concept may be of great value but be framed in a way that obscures its benefits. The opposite is also true: an undesirable design embedded in a well-told story may create issues of distrust with the design and the world the design inhabits. Creative writers talk of trustworthy vs. untrustworthy narrators, and how they influence the reader's ability to engage with the world beyond the narrator [13]. Flawed narratives or an unreliable narrator cause readers to

disengage prematurely with the story and, ultimately, the design. An optimum experience is one in which a design is nestled within a story that engages the senses and encourages users to dig into their past experiences to rectify the tension between the design and the story. This rectification may involve sharing a personal story with the designer to discuss a concept's desirability, or it may involve the user co-creating a more desired design intervention that is driven by personal need and experience.

The following section describes the reader progressions and design implications that emerged as a result of a research study we performed on design-driven narrative.

#### METHODOLOGY

For this project we created five near-future lifestyle design interventions for evaluation with participants as part of an ongoing iterative and creative design process. Our aim was to build on traditional participatory design methods (*e.g.* [24]) by engaging potential technology users early in our ideation process, and studying the relationship between narrative and design in the evaluation of our evolving design. This work took place in the context of a graduate design thesis project exploring the intersection between narratives and design for future forms of entertainment and product development. The authors are an interaction designer with a background in creative writing and an assistant professor of HCI whose background includes 15 years of experience as a design consultant. Our process began with an open-ended discussion of the role of narrative in current technological (transmedia) and postmodern (*i.e.* [26]) contexts, and speculation on what narratives might look like as technology progressed in the future to allow more direct audience engagement. We also discussed the idea that human-centered design occasionally ignores the more complicated and “messy” desires of people while focusing on desires that are more easily solvable [12]. We then held a series of three open-ended brainstorming sessions, lasting approximately one hour apiece, with a group of graduate HCI and interaction design students in our design research laboratory. Each brainstorming session generated approximately 60 rough ideas, with the aim of generating as wide a set of narrative interaction concepts as possible. The questions we asked our participants were:

1. How might we embed narrative in something?
2. How might we encourage people to communicate complicated desires?
3. How might we extend narratives across both physical and virtual environments?

At the end of each session, participants voted on their favorite handful of ideas, paring the total 180 rough ideas down to approximately a dozen favorites. From these we elaborated five concepts that touched upon the more engaging elements of our brainstorm sessions in more detail through sketching and iterative idea development. These concepts were chosen because they emphasized a broad range of characteristics that would allow us to explore the

role of narrative in design—spanning “immediate” narrative experiences to long-term goal planning—and addressed a spectrum of communication and experience from public interactions to private desires and needs, as shown below:

**City Channel:** The City Channel is the brain of the modern city—a new imaginarium of information constructed in real-time through information, data, stories, activities, contextual games, and narratives to create an emotional health for neighborhoods and support safe and social play for children and their parents.

**Desire Plot:** Your Desire Plot is an interactive visualization to help you plan and achieve your desires, updating in real time to show how even the smallest decisions—such as buying a cup of coffee every day—impact the bigger desires, such as saving up for a car.

**Meaningful Markers:** Meaningful Markers teaches kids to explore, play, and make smart decisions in a game setting with their friends and parents. Participants can set time limits, locations, the number of players, and goals for geolocative games that promote neighborhood exploration and social interaction. By mixing game challenges with real world activities, kids begin to see the real impact they can have by doing the right things for their environment.

**VirtualMe Beacons:** Your VirtualMe Beacon is a mobile projector of your interests, wishes and desires, communicating securely with the spaces around you to facilitate deals and transactions for the goods and services you want. Using your mobile GPS, your beacon searches the cloud for content related to your interests, and communicates invisibly with inventories and local storeowners on your behalf.

**EmotoMeter:** A lifestyle optimizer that also interrupts moments of stress to provide brief relief through personalized content, such as sounds and images.

At this stage of development, it is common for designers to build an interactive prototype (*e.g.* in Flash) and ask users to perform tasks to evaluate the concept for usability purposes. They would test to ensure that the navigation is intuitive and there are no systemic user interface errors. What they may not always test as explicitly are the deeper and more personal responses to the application and functionality of the design. Using interactive prototypes may indicate the usability of a system, but can fail to address the usefulness or “stickiness” of the design intervention.

In our study, prior to prototyping each design, we created stories and narrative explorations about each concept. We then produced an 18-page illustrated storybook containing a brief introduction to a hypothetical future world, followed by five concept-centric “chapters” in which different narrators engaged with each unique design concept.

A sample page from this booklet is shown in figure 1. Each chapter was also illustrated with a full-page rendering of the concept in question (figure 2). The booklet was designed as an artifact to be used in our study of narrative as part of the

# City Channel™

a modern city imaginarium

by Maureen Branigan

My kids are (positively) addicted to the **City Channel**, and I couldn't be happier. It's interactive, they're not in front of a television, and they are learning about the environment and their neighborhood. Whenever we get a ping that there is a new game or challenge, you'd think it was Christmas morning around here. I'm glad they can't wait to go exploring on the weekends, and that these games actually benefit the environment and our neighborhood at the same time.

What is the **City Channel**? I think it's basically the stories of the city, funneled through a big neighborhood filter that gets rid of the crap spam offers and all that. Like, it pointed me to a free cooking series at Giant Eagle. All I had to do was find a sitter for a couple Wednesday evenings, and now I'm making more salsa than I can consume. Thankfully my neighbors love salsa too.

For the kids, the **City Channel** is like a neighborhood cartoon. Everything from photo albums and free music by local bands, to information on kid-friendly events and visualization games that keep the kids occupied. My oldest thinks the pictures of the dogs are cute. I can't tell him that some of them are lost and some of them are mutts needing adoption. Next thing you know, we'd have a dog.

One thing you learn when you get divorced is how important it is to be self-sufficient. You've got

play dates to coordinate, which leads little time for real dates, but that's okay. The **City Channel** keeps me and the kids busy with stuff to do, places to explore, and experiences to share. And maybe I meet some new friends through the whole thing. Which brings me to Jim Trumball.

A couple weeks ago we were in Shadyside at the toy store on Bellefonte. A couple in front of me were talking about a haunted hayride in Lawrenceville and I interrupted to ask them where and when it was. They told me they'd seen a post on the **City Channel**. They found the event info and then bumped phones, transferring the details to mine. A haunted hayride for the kids, with free pumpkin carving competitions and hot apple cider from the little tea shop on Butler Street. And so that's where I met my sweetie, a perfectly wonderful guy named Jim Trumball. He's divorced with 4 kids. We probably wouldn't have met if my oldest hadn't been throwing around scoops of pumpkin guts. So maybe true love is forged over a crying child and gooey pumpkin pulp.

It's also a great place to start new communities. I used to bike when I lived in San Diego, but that was like three decades ago. I always wanted to get back into it. So the kids were getting haircuts in Bloomfield and I was killing some time at a **City Channel** screen. On a whim, I decided to ping the neighborhood and see if anybody wanted to put together a riding club. I wanted to get back in, but needed some others to keep me motivated. I posted in the Voices space and later that afternoon I had 4 responses. The next day, I had 8.

We call ourselves "Cyclists Pushing 40." We're not all that fast, but that could have something to do with our recent integration of local bakeries and cafes into our weekly riding routine. Not that any of us are complaining.

Figure 1. Intro text for the *City Channel* chapter.



Figure 2. Image of the *City Channel* prototype in a public space.

interaction design process. We made a conscious decision to not present deep interaction descriptions for each of the concepts. Instead, the book presented a series of vignettes where unique narrators told stories about how one or more of the design concepts played out in their life. As research participants talked through how they might use such artifacts in their own lives, we were able to investigate how people created personal performances out of the literature and test the application of reader response theory as it applies to design.

We then conducted directed storytelling sessions, first informally with four students (two male and two female, ages 24-27), and then formally with eight students (five male, three female, ages 20-32) in the Human-Computer Interaction Institute at Carnegie Mellon University, followed by two rounds of iterative prototyping. Participants are referred to by their participant number, P1 to P12, and were recruited during a weekly lab meeting. Although our participant pool was small, participants represented a diverse

cross section of the interaction design and human-computer interaction graduate student population (*i.e.* majors in design, computer science, HCI, robotics) with varied cultural backgrounds, and expressed a high level of interest in narratives and design. We strived to bring wide range of cultural perspectives to the project, deliberately recruiting international participants and students with varied professional backgrounds, including one architect and one communication designer with deep experience in designing communication plans for urban areas. We also worked to engage participants who were not avid consumers of narrative content. We recognize that these decisions introduced limitations to the generalizability of our findings, and that performing the same tests with an audience with greater diversity and interest would yield richer results. Our intention was to engage participants as co-creators of both the narratives and the design concepts, and to assess the value in using ambiguity to inspire participants to suggest alternative narratives around which a design might grow.

One week prior to the interviews, participants were asked to read the book and to make notes in the margins if so inclined. The first part of the interview was a semi-structured discussion in which participants were asked questions about the stories that they read and the concepts in them. We then asked them to talk through the believability and ambiguities of each story. These sessions took place with the storybook on the table, which we used to discuss the cause of recounted responses.

Interviews lasted 60-120 minutes, and took the form of conversational exchanges as though discussing a book rather than a prototype. Participants were asked a variety of questions about the narrative and the concepts, such as:

- How might your perceptions of the designs have changed if they had been presented as part of one story with a single character using each of the artifacts?
- You say you'd likely never use concept X...can you talk a little bit more about why you feel that way?

Audio from these interviews was recorded and later transcribed. Transcripts were then synthesized using an iterative grounded theory approach [17]. During the interviews, instances in which a disruption occurred between the narrative and concepts were followed-up with additional questioning to identify the genesis of the disruption for the interviewee.

In the time since these interviews took place, one author has used the narrative-driven design methods discussed herein in his work as a senior interaction designer at an innovation lab at AT&T. Specifically, he has used ambiguity in crafting stories to prototype near-future mobile service offerings with 10 research participants. Using stories with varying levels of ambiguity, users engaged with texting/SMS services that allowed them to send and gauge the location of their friends, as well as find and accept deals transmitted from within their environment. The methods of designed ambiguity discussed in this paper have since been adopted by the small design team at AT&T and are used as part of their professional design toolkit.

**FINDINGS: DESIRABILITY, TRUST, AND AMBIGUITY**

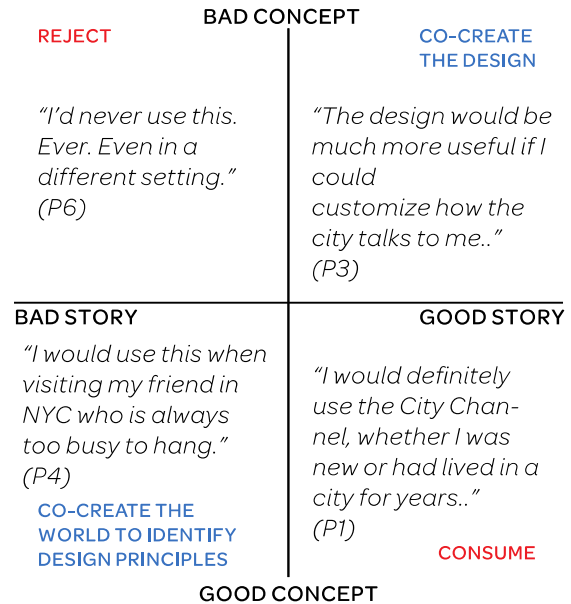
While participants were asked specifically about the concepts contained in the story, it soon became clear that desirability referred not only to the concept (e.g. “I would (or would not) use this”) but also to the narrative itself (e.g. “This aligns (or does not align) with my beliefs and interests”). Whenever a participant expressed resistance towards a design, the source of that resistance was examined through a series of follow-up questions—was it the story, the design, or the interaction between the two? In some cases participants’ opinions stemmed from issues of the story’s fidelity, and in others they indicated issues related to personal taste. We soon learned that when participants expressed “not liking” something, it frequently suggested a perceived misalignment of either the narrative in the design or the design in the narrative.

For example, one user explained that she was interested in one of the concepts and what it could do, until she interpreted a character’s actions as being distrustful and deceptive. At that point, she confessed to being disinterested in the concept and story, despite her prior stated interest. She described her feelings about the “quality of trust” in mobile services in her life, and how she often felt like she was giving up small pieces of her trust to companies only to eventually feel like her trust was betrayed. This discussion helped us document a spectrum between public/social and private/personal interactions upon which future design interventions might be placed. In traditional design feedback sessions, designers might have structured the questions to encourage feedback on the practicality of the solution or the usability of the design. However, in facilitating the session through narrative-driven design, her feedback quickly outlined a valuable design principle that was soon confirmed by additional interviewees.

We generally observed that personal taste played a stronger role in determining a participant’s feelings about the story than it did in their evaluation of the quality of design concepts. In nearly every case, responses that a design was undesirable could be traced back to narrative properties and story elements that were misaligned with personal beliefs or experiences of the reader.

For example, one reader, when talking about the Meaningful Markers concept—which involves geo-locative storytelling and tagging over spaces—indicated that he couldn’t see this working in Pittsburgh, where the distances between neighborhoods was so great, but he could see it working in his home city of Tel Aviv. He went on to discuss his experiences in Tel Aviv relative to gaps and design opportunities drawn from our story. “Tel Aviv is café after café after restaurant after restaurant, many of them with open fronts. You can see in and understand whether or not you would fit in. You don’t have that in Pittsburgh. Maybe the Meaningful Markers could be used to see inside virtually from the street or from a phone, so that you could see if it is a place you would want to go into.” By embedding the design within a story that invited personal narratives based on experience, we uncovered a design principle: that distance between communities played an important role in the use of mobile solutions to navigate not only the space but also the distance between the communities.

We generally observed “undesirable” concepts to mean one of three things: the story wasn’t appealing, the narrator seemed untrustworthy, or the story took an unexpected turn that interrupted the user’s engagement with the design. We use this observation as an underlying framework—described in the following sections—for building narratives that use embedded artifacts to create deeper levels of immersion and engagement for readers. This framework begins with an initial baseline of trust and interest, and looks at the causes of sustained and betrayed trust, and how narrative dynamics work with the embedded design to create pleasurable experiences between the creator and the audience.



**Figure 3. Reader responses mapped to design concepts. The top right & lower left quadrants represent our primary area of focus.**

Figure 3 outlines user responses to the variation in story and concept classification. Specifically, we identified five findings that are causal throughout the narrative-driven design process:

1. Good Narratives Build Trust and Facilitate User Stories Based on Positive Experiences.
2. Betrayed Trust Creates Confusion and Rejection and Facilitate User Stories Based on Negative Experiences.
3. Reader Experiences and Expectations Can be Shaped Through Ambiguity.
4. Narrative Dynamics Intensify and Resolve Experience.
5. Co-Creation Fosters Feelings of Ownership and Meaningful Resolution.

**1. Good Narratives Build Trust and Facilitate User Stories Based on Positive Experiences**

We observed that readers approach narrative-driven design with a level of trust comparable to the experience of any other fiction they engage with. Generally, readers proffer a tentative amount of trust in the author’s narrative until it is violated. Indeed, in nearly all cases the audience for a work of fiction has agreed to “sign up,” whether in the context of an entertainment experience or, as in our case, a usability study.

Engagement with the fiction increases the reader's willingness to extend greater levels of trust. On the surface, trust relates strongly to the aesthetic qualities of the story. Is the plot engaging? Is the narrator likeable? Does this near-future world feel real to me? While not unexpected, we observed that increasing involvement with the story leads to increased immersion in the world the design is situated within, supporting existing literature from reader response theory (e.g. [21, 22]), and more recent literature on convergence culture and the desire for immersion (e.g. [23, 32]). However, this is an important principle to recognize because earlier research in reader response theory was limited to printed words on a page. Our findings involve interaction of the audience with a story and a designed artifact that can be used to expand the interactivity of the design concept.

Good stories have a beginning, middle, and an end, which chart the tension between the relatively uncomplicated beginning and the resolution of a struggle introduced in the middle [27]. This progression closely matches the stages at which humans have an experience, as described by John Dewey, for whom 'having an experience' means reaching a satisfactory conclusion [8]. With regard to interactive technologies, Laurel describes this mapping in response to traditional dramatic narratives structures [25]. Good stories in the traditional narrative sense also introduce reliable characters and objects that serve to advance the narrative through the interaction of characters [13]. How designers choose to illustrate the climax of narrative-driven design may involve ambiguity to heighten the eventual feeling of resolution. Resolution comes from the satisfying of a tension or ambiguity, either on the page or in the mind of the reader.

An engaging narrative that introduces a desirable concept accomplishes two things: (1) it sets expectations regarding the arc of the story to come (*i.e.*, foreshadowing); and (2) it leverages descriptive "ambiguity" to guide the reader to a satisfying conclusion. Here we see a mapping of best practices for narrative builders (writers, etc.) to the goals of designers: to create expectations and shape the potential for satisfactory outcomes. Eleven of our twelve of participants indicated that what ultimately makes a good story effective is their participation as they "fill in the blanks" in their mind. The introduction of the design within the story is also a key consideration. If a poor design is introduced relatively early, the reader might just stop reading. If the design is introduced much later—after the reader has developed an emotional attachment to the story world—the reader may turn inwards to make personal meaning of the story and the concept, attempting to draw upon their experiences to reconcile the broken trust perceived by the story and justify their initial perceptions of value in one or the other. Everybody that we spoke with desired a story experience that allowed them to step in and become part of the emerging narrative.

In summary, because of this baseline of initial trust, we observed an opportunity for narrative designers to author situations in which trust is carefully guided to deliver a desired outcome—one that finds the story and design in harmony—

as well as value in authoring situations that manipulate trust to probe at deeper insights. When trust is maintained the payoff experienced by the reader is a suspension of disbelief and engagement, even if only at a shallow level. As P3 said about the City Channel narrative, "I guess I trusted the story because it rang true. My mom is divorced, and even though the kids in the story are younger, I could kind of see us putting her through that, trying to get her to adopt a dog for us. It did make me think of all the puzzles she got for us when we would take car trips as kids." Trust may be lost and gained if the story world changes significantly to account for the introduction of disruptive design concepts. This points to the necessity for a careful orchestration between the story and the design concepts from start to finish.

## **2. Betrayed Trust Creates Confusion And Rejection and Facilitate User Stories Based on Negative Experiences**

Betrayed trust is a misalignment of a reader's expectations and what actually happens. It may begin with the reader thinking, "Ahh, this was X until Y..." where X is a personal emotion and Y is an inciting incident from the story, or a description of the design concept. As P1 stated, "This was a desirable concept... until I felt like the narrator was going to use it to cheat on his girlfriend." Though it wasn't the author's intent to suggest the character was cheating, the viewer perceived it to be so and the story did not refute the reader's belief.

For example, if a reader is reading a story that depicts a gadget that seems to make life more pleasurable, and if the reader has identified and established some desire for the design, the reader can say he has come to trust the expectations set by the design, and the world in which it has been situated. However, if the narrator of the story is revealed to use the design for improper or ambiguous means, the reader's sense of betrayal may extend beyond the story and to his perception of the design as well. Betrayed trust is at the root of every great film with a poor ending. "You had me right up until the point when," we might say. Inconsistent characters, implausible plots, and *deus ex machinas* (*i.e.* "gods in the machines" who intervene and change the narrative direction by breaking the reality of the story world) are prime culprits in our feelings of betrayal in narrative and cinematic worlds.

Betrayed trust sets forth a tension that then pushes the reader into a new space of power and decision making, which is defined by: (1) ambiguity that is intentionally designed to influence the reader, or (2) ambiguity that is unintentionally created due to a flawed story or concept. As we discovered during our research sessions, readers who felt a betrayal with the story but developed an engagement with the concept read further to attempt to make sense of the narrative and find a story in their personal experiences that would justify their interest in the concept and thereby resolve the betrayal caused by an element of the story. This led to them offering narratives that matched personal experiences, and discussing the negative aspects.

One interview participant responded positively to the Desire Plot concept, despite their disinterest in the narratives that

were told. While the initial story was about setting goals and desires in a realistic fashion, P5 began by describing how she is constantly surprised to see how much she spends on items such as coffee, gum, and snacks by the end of the month. For her, the Desire Plot was valuable because it highlighted the mounting cost of such small items, and how those items impacted her ability to realize bigger goals, such as buying a car or house. With her feedback, a new design principle of awareness through subtle reminders and interactions became apparent, shading the redesign with new value.

Similarly, readers who were engaged with the story but felt the concept was undesirable dug into their experiences and existing needs to talk through suggestions about how an improved version of the design would cause a greater alignment between story and concept, as well as how it would have played a role in their past experiences. What is important to note is that in these cases, nearly all (ten of twelve) participants began talking about their deeper needs and desires, and began discussing the concepts as actual design interventions that could bring real change to their lives.

This was exemplified by P6's comments on the City Channel story and concept. The idea of a narrative-backed AI city was quite interesting to him, and the idea that touchscreens and tablets would be available for interaction in public spaces was interesting. But he also felt the design was missing something. After discussing it with him he observed, "It almost feels like this is too focused on adults. What about kids? And parents with kids? Parents that I know are always looking for little things to keep their kids occupied and learning." These were commonly shared perceptions as we interviewed more participants, who also felt that the design was adult-centric, and would be more engaging as a discussion point if it felt more applicable to society in general. Five participants (P4 through P8) went back and discussed the entire City Channel concept from the eyes of a child and a parent. In this way the opportunity to develop geo-locative games that could start on a tablet and then move into a neighborhood became clear, in which the parent could control the game via a mobile device.

In summary, the emotions (and responses) that occur when a reader feels that their trust has been betrayed present an opportunity for narrative designers to take risks and encourage audiences to develop deeper connections to the design-driven narrative through experiences in their past, as well as needs they face in their current personal lives. Trust can be manipulated in such a way that research participants are able to move beyond commenting on functionality, and begin to discuss the ways in which the design would impact their lives. As P4 observed regarding the Meaningful Markers story, "It was like one of those films that are great... just up until the end when the lead character does something totally out of character just so the ending makes sense. I just didn't buy the last 30 seconds, and as a result, I would never recommend the movie or watch it again. If it had ended in a way that was somewhat consistent, I'd probably have it on my shelf to watch over and over again."

### 3. Reader Experiences and Expectations Can be Shaped Through Ambiguity

When expectations remain unconfirmed or when they are violated, ambiguity is the likely culprit. One method to create or betray trust is therefore to leverage ambiguity to set or dispel expectations. Once expectations are confirmed or restored, the dramatic resolution of the story can be achieved. When expectations are rejected, readers experience a lack of trust in the story, the design, or both [14].

We observed that ambiguity exists in two forms in design-driven narratives when readers experience conflicted expectations. First, there is the carefully crafted ambiguity that serves to lead the reader to that "ah-ha!" moment when the world is suddenly viewed through a new filter and the source of the ambiguity is made clear. This resolution is typically non-immersive, and is a carefully designed use of narrative flow and dynamics to resolve the drama, as with a mildly surprising and pleasant ending. The initial emotion is strong, but fades quickly. In this case, the story exists as a mediated experience between the storyteller and the audience.

Second, there is a level of ambiguity that should be carefully designed to provide room for the reader's involvement and responses to the story. As readers encounter ambiguity or confusion, they may reach back into their past experiences to identify a story that might resolve the ambiguity they perceive. For example, upon reading a piece of design-driven narrative, a reader might say, "This new alarm clock concept sounds useful, but I'm not sure the story fits my life since it talks about an airline pilot who keeps wildly inconsistent hours. However, it kind of reminds me of when I was a student, when I could have used something like this. And I imagine this might be of value to new mothers who must constantly..."

This type of cognitive mapping of an existing story from a catalogue of experience-based stories onto a present experience can lead to a more personal resolution of narrative ambiguity and lead to feelings of greater ownership. Thus P2 stated "I would use the Desire Plot if it was something that was live, and not something I had to constantly tinker with like the narrator does in the story." This type of ambiguity moves the reader away from traditional author/reader relationships, and allows the design-driven narrative to create the opportunity for a performance *from* the reader. In this case, the story becomes an unmediated performance by the reader as they search inwards for something that will ease the ambiguity designed into the fiction. The experience of deconstructing the ambiguity itself changes our understanding of ourselves and the base of experiences from which we make sense of new and confusing situations.

In summary, because of the value we see in responses from readers who feel more engaged with a concept that allowed them to map an existing personal experience in place of the presented story, there is an opportunity for narrative designers to consider crafting experiences in which the story and concept act as vehicles for performance that are directly accessible to both the storyteller and the audience, in an effort to create deeper attachments to the concept in the long term.

#### 4. Narrative Dynamics Intensify and Resolve Experience

At a mechanical level the design of narrative ambiguity involves a skillful balance between those dynamics in the media (*e.g.* text and images) that hint at the artifact, and the narrative arc of the story itself. In traditional storytelling, the words on a page are responsible for creating relationships between the story and the reader. In the design-driven narratives we evaluated, there was a curious interplay between the words and the visuals. Something as simple as a choice of words can lead readers to faulty conclusions about both the design and the story.

The point at which a concept is introduced to a reader is key to his or her sustained engagement over time. It also has implications on how deeply they are willing to have their expectations violated before seeking a resolution internally or putting the story down; opting out of the designer's offer.

#### 5. Co-Creation Fosters Feelings of Ownership and Meaningful Resolution

The type of ambiguity mentioned in finding 3 relies on human experience to reach a resolution. This experience is created when media is situated as a vehicle for a performance, rather than as something that sits (and “broadcasts”) between creator and audience. The experience of making sense of the ambiguity in the story challenges the traditional storyteller/audience relationship, thrusting the audience into the position of becoming co-creator and assuming narrative authorship. The blanks that the reader fills in may not be those envisioned by the storyteller; what matters is the experience and interaction that took place, and the way in which the audience then catalogues that experience in their memory.

As P2 observed, “If I could tweak this and use it to see into a story before I go in, it would help with some of the cultural confusion in Pittsburgh. You walk into one bar and it's a bunch of old men in their seventies drinking at 9 am. If I could somehow see that, or if it was all couples and no single people, it would help me decide how to spend my limited free time.”

P6 noted that in sharing a story from his experiences, his interest in the concept grew stronger as we talked about potential stories of use, even though his initial opinion of the design was disinterested. Through our interaction and discussion of both alternative narratives around the design, and the elements of the design that felt ambiguous, his engagement and sense of attachment to the narrative-driven design grew.

In summary, because of the intrinsic value in co-creation between storytellers and audiences, narrative designers have the opportunity to consider authoring situations in which resolutions are the result of experiences that allow readers to assume feelings of ownership through co-creation that resolves ambiguity. Allowing them to seemingly shape the direction or intention of a design allows them to project into a near-future world, where this design would satisfy a personal need. The satisfaction of co-creating such a desirable concept greatly outlasts the immediate enjoyment of the “ah-ha” moment when readers are brought to a delightful yet totally expected—and scripted—conclusion.

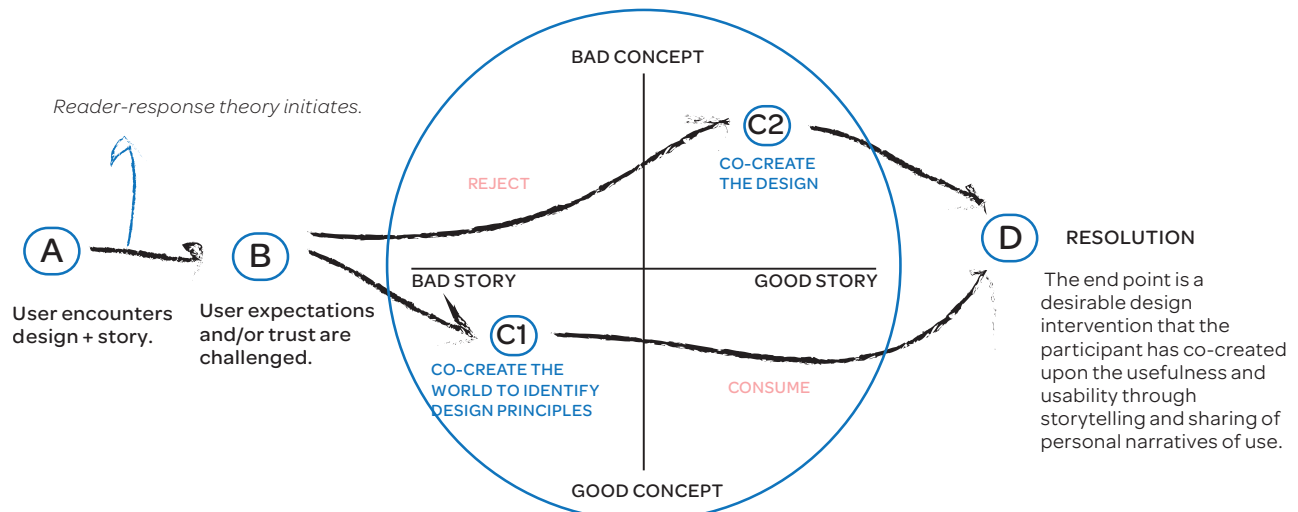
#### DISCUSSION

New methods of prototyping concepts will help designers better refine and design concepts that fit a perceived need or desire. Since stories are the vehicles by which we make sense of the world and by which cultures develop, there is inherent value in situating designed concepts within near-future story worlds to help draw out their readers' experiences of use, particularly as it might inform the usefulness or desirability of a concept. Critical design has used a marriage of narrative and design to prototype concepts and services, but in these cases, the narrative often describes a world with values far different from those that exist in our current world [9]. We are interested in prototyping concepts that exist in the present, however—or in the near future where value structures remain the same as in the present.

Putting an unfamiliar design concept in front of a user and asking them what they think, how they like the layout, and what their visual perception of it is leads to responses focused on usability, although Shedroff argues that users engage in a similar form of reader-response theory when they engage in prototyping sessions [34]. While they are bringing a number of experiences and expectations to the table, the majority of prototyping sessions are so carefully structured that the reader-response is heavily suppressed. Giving users a story that teases their imagination encourages them to connect the concept to experiences in their past, and suggests a more active co-creator role that inspires answers like, “I might use this to see what my friends are recommending, but I'm not sure I'd be inclined to spend a lot of time leaving stories about spaces unless I got something tangible in return” (Meaningful Markers, [P2]) and “I would use this to help me gain control of my out-of-control spending and credit debt.” (Desire Plot, [P5]) The first set of responses addresses merely the aesthetic and functional. The second set addresses the degree to which they can see the concept making an impact on their lives, and empowers them to discuss desires for the future—which we believe is the goal of design.

In our study, deeper immersion in a story produced more complex responses and reactions to the narratives and the designs. In one of the short stories we evaluated with participants, the narrator was described as “sneaking off” to leave comments and document experiences in a space to create a visualization of his relationship with his girlfriend to surprise her later on. The phrase “sneaking off” caused two readers to deduce that the narrator was “a cheater,” and therefore the design itself was enabling infidelity in some way. Other readers felt that the design should be simple and present the narrator with a list of places visited in a pre-determined timeframe, such as at the end of the day, so that interaction could occur post-event rather than in real-time. Certain phrases and actions in the narrative we designed triggered a reader response, sending their understanding of the text in unanticipated directions. Rather than suppress the responses that originated from these readings, we provided participants with a means to expound on their desires and impressions. As





**Figure 4.** Readers started each story with a sense of trust (A) in what was to come. At some point in the story, trust was broken (B), either through designed ambiguity (C.1) which was crafted to provide a guided path to the resolution of the story (D), or through the reader perceiving misalignments in either the story or design (C.2). Resolving (D) from (C.2) takes the form of co-creation, where the readers tell a story to restore trust in the design, or shape design attributes based on personal history. This research focused on designed/intentionally manipulated ambiguity, and as such, we are not concerned with the implications that occur when a reader Rejects or immediately consumes a narrative in a way that does not challenge them to engage.

designers, we grapple with this every time we put a prototype in front of a user. Their responses often illustrate unforeseen problems and considerations. The question this research has asked, is how might we use these responses to our favor? How can designers manipulate the perceived experiences of their users to engage and violate their expectations, encouraging intended and personal responses to our work?

In conclusion, figure 4 shows the key elements of narrative progression that we discovered through sessions with users. The five states shown above (A, B, C1/C2, and D) map to the five key findings discussed above. This summarizes our results and indicates the following:

- The progression from A to B occurs at the moment people begin a new experience with a narrative or a design. Initial trust and assumptions change upon interaction, and continue to evolve throughout the experience [8].
- The break in trust, B, occurs when one of two things happens: (1) ambiguity is intentionally introduced, or (2) the participant perceives a misalignment and rejects either the story or the design.
- Wherever the *story* was the source of misalignment, C1, participants in our study commented on the design as it related to their experiences: they took the role of co-author and explored the world of the design. This presents designers with an opportunity to manipulate narrative elements to define the social boundaries shaped by the design, and help document design principles.
- Wherever the *design* was the source of misalignment, C2, participants discussed the flaws as they related to personal narratives, and became co-creators in the design by sharing personal narratives. This presents designers with an opportunity to gain deeper levels of interaction with

their users and the design itself by engaging in personal co-creation that is rooted in personal user experience.

Our findings indicate that designers must be highly attentive to the specifics of good storytelling in order to tell the right story for the right time and audience when prototyping artifacts through narrative; which is always, whether the designer is conscious of the narrative or not. Ambiguity must be carefully crafted to shape the space in which the readers can expand upon their desires regarding the concept. Shaping ambiguity requires a deft hand. Too much, and the reader is pushed into a state of confusion where they are forced to take action. Too little, and the story provides little opportunity to provoke meaningful narratives for prototyping purposes.

While reader-response theory has been heavily discussed in the world of rhetoric, it has a great deal to add to the HCI design community and our growing toolkit for prototyping concepts and experiences. However, we must move beyond the more traditional forms of human-centered design research methods and use a deft hand to provoke dreams and desires using the inherent human desire to share our story.

To that extent, we see the highest value in embedding provocative designs within story worlds that are ambiguous and which provoke readers to connect the desired design with personal stories that illustrate deeper desires and opportunities that the design concept would address.

We realize that there is much more work to be done at the intersection of design-driven narrative and human-centered interactive systems design. This paper describes a single qualitative study with limited participants, and the fidelity levels of the early prototypes were at a discrete stage of development, highly contextualized, and presented in a format that certainly influenced the kinds of results we

observed. There is also far more theoretical work to be done in this area to extending reader-response theory more comprehensively to critical theories of interaction design and prototype evaluation. Our plans for future work include the development of a more explicit and comprehensive set of guidelines explaining the nuanced mechanics of design-driven narrative and their empirical relationship to the relevant theoretical frameworks. To this end, our aim is to continue developing follow up research that presents higher-fidelity prototypes of each of the concepts articulated in this study design, allowing us to map a larger set of user data throughout the design process, and we plan on increasing the size of our participant group via interactive prototypes to enable more comprehensive quantitative as well as qualitative data to be obtained.

This research presents an opportunity for designers to take prototypes to people and present them in ways that mimic how humans are increasingly living their lives—in multisensory, narrative driven ways. Borrowing techniques from the cinematic arts, designers will increasingly create higher levels of immersion and engagement with interactive artifacts, helping people articulate deeper needs and desires in the process.

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